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BUTTERFLY-HUNTING IN MANY LANDS

NOTES OF A FIELD NATURALIST

BY

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TO WHICH ARE ADDED TRANSLATIONS OF PAPERS BY FRITZ MÜLLER ON THE SCENT-ORGANS OF BUTTERFLIES AND MOTHS: WITH A NOTE BY E. B. POULTON, D.Sc., F.R.S.

8 FEB

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ERONIA CLEODORA, HÜBN.
ON THE WING AND AT REST.

To my Old Friend & Fellow Aurelian

Selwyn Image

Slade Professor of Fine Art at Oxford

these tales of the net

are affectionately dedicated

PREFACE

SUCH a book as this needs an apology. It is an attempt, possibly a foolish one, to put into a readable form the technical diaries of a wandering entomologist, and to entomologists alone it appeals. The basis of the work is a pile of note-books containing long lists of specimens taken from day to day. Nothing but the favourable reception by brother naturalists of papers dealing in like fashion with some of my earlier voyages would have induced me to undertake the heavy task. Yet, even in these days of easy travel, it has not been the lot of many to have collected insects in every continent.

I have to thank the President and Council of the Entomological Society of London for kind permission to reprint papers which have been read before that Society, and to reproduce the frontispiece and some of the figures in the text. My thanks are also due to the Editors of the *Entomologist's Monthly Magazine* for allowing me to make full use of my contributions to that Journal, now extending over many years.

The original papers have been revised, and in many places matter has been added that is not entomological, nor even scientific, in the hope of lightening an otherwise monotonous narrative.

The chief results of my observations have been gathered together and classified in the last chapter, and it is my fond hope that from the details there set in serried array some inferences of enduring value may be drawn.

The constant changes of nomenclature are a source of trouble to the collector no less than to the systematist. I lay no claim to consistency of treatment. In the first chapter the names that I was familiar with in school-boy and undergraduate days are used, but to facilitate identification the name given in Mr. R.

South's list is in some instances added in brackets. The author's name is in that chapter given only in cases of difficult synonymy.

All authors' names, of genera as well as species, are given in the Index, but in the text the name of the author of species only is given, and that but once in each chapter.

Generic names in brackets are sometimes those of sub-genera, sometimes synonyms: they are given solely to facilitate the identification of species figured or described in much used works.

Inconsistencies of nomenclature no doubt occur; they are partly due to the fact that, *e.g.*, Bingham's "Butterflies of India" appeared after my captures of 1903–4 had been determined, partly to the fact that I have not felt equal to harmonizing the occasionally discordant determinations of specialists.

The names of insects alluded to merely by way of illustration or comparison are not indexed. Names of plants are indexed by genera only, and the natural order is given in brackets. The Appendix is not indexed.

My knowledge of systematic entomology is very slight and almost confined to the Butterflies, hence as a collector of Insects of all Orders, in diverse parts of the world, I have been more than usually dependent upon specialists. My thanks are due in the first place to the Entomological Staff of the British Museum, without whose kindness the large majority of my captures would be still unnamed. Valuable help has also been received from Mr. G. T. Bethune-Baker, Dr. Malcolm Burr, Mr. J. E. Collin, Mr. H. Druce, Mr. H. H. Druce (who has devoted much time to my Blues and Skippers), Prof. Selwyn Image, Mr. W. J. Kaye, Mr. G. A. K. Marshall, the Rev. F. D. Morice (who named my Egyptian and Sudanese Hymenoptera), Mr. L. B. Prout, Mr. R. Trimen, F.R.S., Commander J. J. Walker, and Col. J. W. Yerbury. Other kind helpers are mentioned in the text.

Some to whom I owe much have been lost to entomology since this book was begun: C. T. Bingham, Martin Jacoby, Edward Saunders, and G. H. Verrall have truly left gaps that it will be hard to fill.

To the skill of Mr. Horace Knight and his son, Mr. Edgar S. Knight, my book owes any attractiveness that it may possess.

PREFACE

Mr. F. R. D. Onslow and Mr. R. Shelford have spent much labour on my proofs, and I am deeply indebted to them; Mr. Shelford's acquaintance with the East and extensive knowledge of Oriental insects of all orders has been of especial value. He had previously named many of my Orthoptera.

At Professor Poulton's suggestion I have printed in an Appendix translations by Mr. Ernest A. Elliott, F.Z.S., F.E.S., of a series of papers by Dr. Fritz Müller, dealing with the Scent-organs of Lepidoptera. These valuable papers, written in German or Portuguese, were difficult of access, and hence too little known. I am greatly indebted to Mr. Elliott and Professor Poulton for their laborious assistance in this matter. The original illustrations have been reproduced.

I have reserved to the last those to whom I am most deeply indebted. Dr. Dixey, F.R.S., has for many years been one of my most intimate friends, and he alone knows how much, and in how many ways I am his debtor. The Hope Professor of Zoology at Oxford, Dr. E. B. Poulton, F.R.S., has for the past seven years placed the resources of the department under his charge—and his able staff of assistants—at my disposal, and ever welcomes me on my frequent visits to Oxford, helping me in all sorts of ways.

G. B. LONGSTAFF.

MORTEHOE, 1911.

NOTE

THE late Col. Bingham's descriptions of the new species of South African Hymenoptera collected by Dr. Dixey and the author, are unfortunately still unpublished. When the proofs of Col. Bingham's paper were received, it was discovered that only a part of the manuscript had been printed. It is hoped that the missing pages, containing the above descriptions, will soon be traced and published as a supplementary paper.

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,, 263, line 5, *read* Fig. 7.
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INTRODUCTION

If the stay-at-home naturalist should suppose that everywhere within the Tropics insects are more plentiful than in the Palaearctic Region he would make a great mistake. More varied they may be—and this is especially true of South America—but not necessarily more numerous. The veteran naturalist Dr. A. R. Wallace, in his "World of Life,"[1] emphasizes the fact that gregarious plants are far more prevalent in Temperate latitudes than they are in the Tropics. Plants such as heather, gorse and the like cover immense tracts of country; while extensive woods are often composed of oaks, beeches, or pines almost to the exclusion of other trees. A tropical forest contains many more species of trees to the square mile than would be found in Europe, Siberia or Canada. Masses of vegetation consisting of few species do not favour a very varied insect fauna, but may be quite compatible with a large insect population. In the more favoured parts of England butterflies make up in numbers for what they lack in variety. At the same time while it must be admitted that within the Tropics butterflies are more familiar objects than in Great Britain, it is certainly the case that insects need looking for in all countries alike; over large areas they may be comparatively scarce, whereas in favoured spots they will be found in great abundance. Such spots are open spaces in woods, whether natural or the work of man, exposed to the *morning* sun and well supplied with a variety of flowers; they are likely to be especially productive if water be also at hand. For some reason as yet unexplained the *tops* of hills, more particularly somewhat isolated knolls surrounded by woods, have a great attraction to many insects, notably swallow-tailed butterflies. On the other hand woods of a uniform character, especially if dense, may be quite poor as hunting grounds. Least productive of all are lands which have been long and well cultivated to the extermination of the aboriginal flora; nor must it be forgotten that tillage is not the only agricultural operation that displaces the native plants, for the constant and systematic grazing of land by cattle, sheep, camels and still more by goats, is

[1] p. 56.

only a degree less effectual. In an area of this kind the few insect inhabitants are such as have adapted themselves, like so-called "weeds of cultivation," to the very special conditions superimposed by the sustained operations of the patient husbandman. Such insects, "our garden friends and foes," to use the apt title of one of the works of the late Rev. J. G. Wood, are often found, like the aforesaid weeds of cultivation, to enjoy a wide distribution.[1] Yet even in well cultivated areas one may happen on oases, so to say, patches of land too wet, or perchance too dry, for profitable cultivation, where many of the indigenous plants survive, and with them some at any rate of the indigenous insects.

Since it would appear that, in spite of all that has been written on the subject during the last fifty years, there is still a good deal of misapprehension as to the sense in which certain expressions are used by naturalists, it seems desirable to say a few words on the Use of Metaphor in Natural History.

We may perhaps assume that now-a-days no one thinks that by the term Natural Selection it is suggested that Dame Nature walks about pulling up the weaker seedlings, or stamping on worms that are slow to get out of the way. Probably the use of the happier term "Survival of the Fittest" has abolished such crude ideas, but the habit of literal interpretation dies hard.

Flies are for the most part very defenceless creatures and have little save the swiftness of their movements to protect them from their enemies. On the contrary bees and wasps are formidable animals well armed for attack or defence. It is common knowledge that many flies are so like bees or wasps as to be readily mistaken for them. Such a fly is said to "mimic" the bee or wasp that it resembles. The bee or wasp is termed the "model." There is good reason to believe that the resemblance is a real protection to the fly, since of its various enemies some, at all events occasionally, mistake the defenceless "mimic" for the well armed "model."[2]

Again certain butterflies, which we have reason to believe afford palatable food to birds and other creatures, are so like certain other butterflies (belonging to widely different groups) which in their turn are believed on good evidence to be distasteful to birds, etc., that, especially during life, the one may be readily mistaken for the other. In such a case the palatable butterfly is said to "mimic" the distasteful, and the two are spoken of as "mimic" and "model" respectively.

[1] For notes on some widely distributed Lepidoptera, see Chapter X., § 12.

[2] For recent experiments see R. I. Pocock, F.L.S., in *Proc. Zoolog. Soc.*, Lond., 1911, pp. 853–855.

Yet again very many insects of various orders bear such a striking resemblance in form, or colour, or both, to the substances, vegetable or mineral, upon which they habitually repose as to be difficult of detection when at rest. They appear moreover in numerous instances to seek out as resting places objects like themselves with a view to concealment, and not infrequently they adopt an attitude which increases their resemblance to their surroundings.

Now in the preceding paragraphs the words "mimic," "model," and the phrase "seeking out . . . with a view to concealment," are used in a metaphorical and not in a literal sense.

The form of mimicry sketched out above will always be associated with the name of Bates, but Fritz Müller has familiarized us with the fact that distasteful insects in many cases appear to mimic one another. They are said to "form," or "be drawn into associations" which "exhibit common warning colours," thereby sharing the risks involved in the education of young birds, which it would appear do not instinctively distinguish between the palatable and unpalatable. Here again many of the expressions used are metaphorical.

So far as the writer knows, there is no naturalist of repute who for one moment imagines that in any literal sense the fly mimics the wasp, or the palatable butterfly mimics the distasteful. There are probably very few naturalists who believe that, for example, a yellow butterfly hunting about for a yellow leaf on which to settle, does so with the conscious idea of getting thereby protection from its foes.

That an insect should consciously assume a certain attitude with a view to concealment is of course conceivable, that it should choose a special background for the same purpose is also conceivable. That an insect by any conscious effort on its part could assume the form, or even the colour of another insect is utterly inconceivable.

Of course what is really meant is, that such and such an insect has been successful in the struggle for existence owing to its resemblance in form, or colour, or habits to such and such another insect which started better equipped for the contest, and that the constant elimination of the less protected individuals has gradually perfected the "mimicry." For brevity's sake the words "mimic," "model" and the like will be used throughout this work—the metaphor is too convenient to be laid aside.

That the Struggle for Existence is severe and does actually result in the Survival of the Fittest is a belief which I share with nearly all field naturalists of experience. But if this be true, this process—conveniently if inaccurately termed Natural Selection—must be a

a scientific society that I attended. Curiously enough, when forty years afterwards I was admitted as a fellow of the Society of Antiquaries, the chair was occupied by Lord Avebury. It is still more curious that on that occasion I found on the table a volume of the newly published "Victoria History of the County of Warwick," and therein came across many quotations from my list of the Rugby Lepidoptera, printed in 1868!

In August, 1858, though not ten years old, I went up the Rhine with my parents, and still remember my excitement on seeing a Scarce Swallow-tail swoop round our party when sitting on the top of the Drachenfels. I have also a lively recollection of pursuing red- and blue-winged grasshoppers among the *Robinia* bushes on Rolandseck. In those early days, however, it would have seemed to me almost criminal to bring a Continental specimen into England, moreover for several years I kept to a stern resolve to admit to my collection none save insects captured by my own hands. Both principles are perhaps good for beginners, but, be that as it may, I can to this day realize my feeling of moral degradation, when, yielding to persuasion in the cause of science, I first consented to exchange specimens (Christmas, 1867). Naturally the new policy increased my knowledge, widened my circle of entomological acquaintances and tended to the filling of my cabinet.

It was in that same summer of 1858 that, in the hotel garden at Koblenz, my brother showed me Donati's comet, then insignificant enough, but the first of those weird bodies that I had set eyes upon. The wine-growers of the Rhine-land were full of hope and told grandfathers' stories of the famous vintage of 1811—the last great comet year. My father joined in the conversation, relating his boyish memories of the great comet, which appeared when he was twelve years old. About a month later, at Wandsworth, on the memorable 5th of October, I saw Arcturus gleaming through the then mighty comet's wide sweeping, gracefully curved tail. It was truly a sight to be remembered, and it was duly drawn upon the pages of many a school book.

But 1858 produced something more than a great comet and a famous vintage; it was a famous year in entomological annals, for all kinds of rarities were recorded in the journals. My own captures were, indeed, not very remarkable, but there is a note that in that summer I saw in my father's garden at Wandsworth a Painted Lady and a Humming-bird moth, both rare visitors to that locality. It was probably in that same year that the Large Tortoise-shell was taken in the aforesaid garden—I remember the turn of the path

where I netted it. Though I have seen literally thousands of Painted Ladies since, I doubt much whether a score of Large Tortoise-shells have crossed my path.

In the earliest of my collecting days that I can recall to mind all orders of insects interested me alike. At one time I was especially keen on water creatures and remember dredging up the strange stick-like insect *Ranatra linearis* from a pond on Wandsworth Common.

When my kind friend Blackmore first showed me Stainton's "Manual"—perhaps the best book on the British Lepidoptera ever published—it was still coming out in *3d.* parts. It was indeed a privilege to be started with such a book in one's hands, and many and many a time have I thanked my stars that I was brought up on Stainton, rather than on the spoon-food of Newman. From the first I learned the Latin names of insects—and found no difficulty in it—and, what is more, learned to name my captures from descriptions, instead of from figures. I have never ceased to regret that "The Manual" did not reach a second edition. A few years later, but still as a small school-boy, it was my privilege to attend some of Mr. Stainton's Wednesday evening "at homes," and I shall never forget his kindly bird-like face, his charm of manner, and, above all, his unfailing kindness to me. Some delightful letters in his lady-like hand-writing are still among my treasures. Later I spent somewhat similar evenings with Edward Newman, Robert McLachlan, and H. G. Knaggs.

I was a collector in the good old days of the *Entomologist's Weekly Intelligencer*, a delightful little paper which told many a tale of the wonderful things caught by the then comparatively new method of "sugar." Thus, for example, *Agrotis saucia*,[1] till then a great rarity, visited the tempting sweets in all parts of the country. A leading article, in 1858, urged the importance of keeping diaries and ended with the refrain: "Let diaries therefore be made." This was followed up by a letter from the pen of S. J. Wilkinson (who was then writing "The British Tortrices") setting forth the best form of diary. The reading of article and letter a year or so later roused my youthful ardour, and I opened the season of 1860 with my earliest diary. This, which lies before me as I write, is inscribed in a farthing blue and white washing-book, and solemnly records in a child's round hand the capture of a "Twenty-plume moth" and of a "Small White." It further describes some larvae found drawing together the twigs of Broom, which must have been those of

[1] Now, alas! neither *Agrotis* nor *saucia*, but *Lycophotia margaritosa*.

Depressaria assimilella—but with this effort, alas! it concludes, saying nothing of visits, which (as I know from other sources) were paid that year to St. Leonard's-on-Sea, Weymouth, and Bonchurch, Isle of Wight.

In the summer of 1861 I again went to Bonchurch, and vastly enjoyed chasing *Colias edusa* (as it was then called), and also took *Pyrameis cardui*, and, on the downs, *Aspilates citraria* (*ochrearia*), and *Botys flavalis*. There is no diary of this visit extant, but I have a small book of pressed flowers from the Isle of Wight collected in that summer. However, in the autumn the diary was resumed in a somewhat less infantile form; the Latin names (specific only) being made use of, even in the case of such a small insect as *Fabriciana*. This diary proves that the larvae of *Caja* were then much commoner in the southern suburbs than they are now.

The next year I spent part of April and May at St. Leonards, and there made the acquaintance in the field of Mr. Edward Cooper; it was his fiftieth birthday when we met, whereas I was but thirteen. However, we both served under the same colours, and at once struck up a friendship which lasted several years. Our chief collecting ground was Hollington Church Wood, a lovely spot, redolent of spring flowers. Well do I remember my delight at seeing *Euphrosyne* for the first time and in great abundance, and with it plenty of that most decorative butterfly the Orange-tip, as well as the cheery little Grizzled Skipper. Perhaps the best thing we got was the conspicuous black and white Pyrale, *Ennychia octomaculalis*, which was, however, not to be had for the asking. In the summer a short time was spent at Deal, whence I walked to St. Margaret's Bay, where in those days there were but three or four cottages. Along the undercliff, by the rifle range of the Royal Marines, an extraordinary profusion of insect life, and that in gorgeous forms, delighted the eye. Every head of Knapweed, and there were innumerable heads, bore a fair burden of at least three or four Six-spot Burnets, and two or three Rose-beetles. Though I have seen *Zygaena filipendulae* commonly enough since then, I have never beheld it in anything like such numbers, still less have I come across such a profusion of *Cetonia aurata*. There is unfortunately no record of the Plumes and Geometers captured on the same ground. Later in the year I went to Tunbridge Wells, and made the acquaintance of *Lycaena aegon*, and the handsome pulpy green and yellow larva of *Hadena pisi*—so conspicuous when removed from its surroundings, but often harmonizing well with its food plant. A short visit to Folkestone is associated with sweet memories of *Lycaena adonis* and *Acidalia*

ornata. It was a favourite amusement of ours (my companion was one Frank Conigrave, then leading treble in the choir of St. Paul's Cathedral) to slide down the steepest grassy slopes that the Warren afforded. Once while so engaged I was fearfully startled to find myself unexpectedly in mid-air—having shot over a small unseen chalk-pit! It fortunately was but a very little one, and my small body landed on the luxuriant herbage beyond practically unhurt.

The diary shows that in the autumn I occupied myself with larva collecting, and in October made my first experiments with a sugar-trap. These were not very successful, for though a lot of *Anchocelis pistacina* and one *Agriopis aprilina* were ensnared, most of the moths were drowned miserably in a soup-plate originally containing nearly dry sugar, which heavy rain had dissolved.

By 1863 a form of diary had been adopted almost identical with that employed in my foreign travels of recent years. In its columns even *Tortrices* and *Tineae* appear with their Latin names in full. It was one of the advantages of Stainton over Newman, that the former made no sharp distinction between Micros and Macros—a distinction the futility of which has been amply proved by modern views on classification. My chief hunting grounds in those days were Wimbledon Common and Coombe Wood, though one expedition reached to Weybridge; it was probably in this year that Blackmore first took me to Mickleham and Darenth. A visit to the English Lakes, and to Durham in the autumn, yielded but trifling results from an entomological point of view. At this time I paid much attention to larvae, and actually wrote descriptions of 43 species, besides those of a few pupae.

The following year was also largely devoted to describing and rearing larvae. It was my ambition to remove the reproach attached to the description of so many species—"larva unknown." Another visit to St. Leonard's in the early spring produced *Brephos notha*, and, what interested me much more, a "bracelet" of the eggs of *Eriogaster lanestris*, from which ultimately a fine series of the perfect insect was reared. At about this time my most intimate entomological chum was my school-fellow Mr. (now the Rev.) C. J. Buckmaster; our chief hunting grounds were Wimbledon Common and Park, and Coombe Wood, with occasional long days at Mickleham or Darenth. In the autumn I went to Ben Rhydding with my parents, but got little on the moors.

It was early in that summer of 1864 that the *Entomologist's Monthly Magazine* emerged. Though but a boy of fifteen, I sent a contribution to the first volume recounting, among other items,

the capture of *Eupisteria heparata* in the alder groves of Coombe Wood, and the finding of eighteen larvae of *Orgyia gonostigma* on Wimbledon Common.[1] These beautiful caterpillars were wont proudly to stretch themselves out on the oak bushes in the hollow below the Windmill, usually on the topmost leaf. In those days I was a very small boy for my age, and yet they were well within my reach. Is the creature really extinct there? or are the larvae, protected by their many brushes,[2] still wont to sun themselves on the tops of the trees far above the heads of the tallest man? For be it known that since the reign of the Conservators began, in 1872, the whole aspect of the common has greatly changed, as they very promptly put a stop to the old practice of "lopping and topping," with the result that in a few years what had been scrub grew into the present beautiful woods. In the old days that I am writing of —full forty years ago—there was a clear view from Tibbett's Corner to the Windmill, nothing intervening save a wide expanse of heather, and a few small birch bushes. That, however, was before the Volunteers and the numerous camp-followers had had time to crush the life out of the heather. But if we have lost much heath we have gained many trees, so that if Jerry Abershaw still swung in chains on Jerry's Hill, as he did in Jacob Faithful's boyhood, he would not be visible to the motorists on the Portsmouth Road hard by. Sad to relate in the course of modern improvements even the stump of the gibbet has disappeared, and if Captain Marryat were to-day to start to walk from his father's house at Wimbledon to Roehampton[3] he would miss one of his chief "leading marks." Another landmark, the yet more prominent Admiralty semaphore, is now remembered by the "Telegraph Arms," erected almost on the site.

The next year, 1865, found me at Rugby, and my collecting was restricted to the then long midsummer holidays. This was not, however, altogether a loss, for at Rugby I was well grounded in Botany, Geology, and Chemistry. The first two sciences at any rate have intimate relations with other branches of Natural History, and so long as life lasts I shall be grateful to Mr. F. E. Kitchener and

[1] *Entomologist's Monthly Magazine*, Vol. i. p. 72.

[2] For the protection afforded to the caterpillars of this group by their tussocks of hair, see Poulton's "The Colours of Animals," p. 196–8.

[3] Joseph Marryat, M.P., purchased "Wimbledon House" in 1815, and died there in 1824. Jerry Abershaw was hanged at Kennington on August 3rd, 1795. The Rev. Bloomfield Jackson says that the post of the gibbet was long preserved as a portion of Mr. Bull's shop at 27, High St., Putney. I owe this information to Mr. C. T. Davis, the accomplished Wandsworth Librarian.

Mr. (now The Venerable) J. M. Wilson for the substantial addition to my happiness that their instruction provided. Unable to collect insects I took to flowers instead, and spent my half-holidays in working for the prize collection. Here again, as with moths, I had the advantage of a book without pictures, Bentham's "British Flora." In the holidays I again worked the Common (getting *Nemeophila russula* and *Anticlea rubidata*), as well as Coombe Wood and Darenth. A July visit to Lyndhurst, my first considerable purely entomological expedition, afforded new experiences. What a glorious sight it was to see *Argynnis adippe* and *paphia* flying about the bramble blossoms! The last named was in profusion. Then there were in denser parts *Leucophasia sinapis* weakly flitting over the herbage, and, even more beautiful, old Haworth's favourite, that "elegant fly," *Limenitis sibylla*, tastefully coloured and with gliding flight of grace incomparable. A later visit to Tunbridge Wells, where I again met Mr. Cooper, is best remembered by a few nights spent at Hever Castle. This appealed strongly to my boyish imagination, and I did not perhaps entirely disbelieve the legend of the hapless Anne Boleyn's headless apparition. Sleeping at one end of the "long gallery," my mother at the other, it happened that late at night I had to go to her room to get something or other. I started somewhat nervously to traverse the long gallery by the dim light of a chamber candle; when half way along an owl swooped down upon me and almost extinguished my light. For the moment poor Anne's ghost was a reality. But, in spite of owls and ghosts, how I did enjoy catching perch in old Sir Thomas Boleyn's moat!

After I had been at Rugby rather over a year I screwed up courage to face the jibes of the boys, and began to collect insects. To elude observation as far as possible, my net was carried in my pocket, the ring thereof round my waist, and its stick, in three joints, carried in a purpose-made pocket, for a Median statute forbade any boy below the Sixth Form to carry a walking-stick. With these precautions I did fairly well, getting such insects as *Macroglossa fuciformis*, common at flowers of Bugle and Ragged Robin, *Emmelesia albulata*, *Eupithecia lariciata*, *Asthena sylvata*, *Boarmia abietaria* and *Hydrocampa stagnalis*. That June the only specimen of *Ino statices* that I ever saw alive fell to my net.[1] An interesting incident of quite different character appears in my diary. The local magistrates had furbished up the parish stocks and naturally itched to make use of them. A worthless fellow got drunk and

[1] *Entomologist's Monthly Magazine*, Vol. III., p. 188.

created a disturbance one Sunday, so they clapped him into the stocks, and kept him there for six hours [June 7th, 1866!]. All the school went to see the man in his durance vile, but the effect was rather spoilt by his brother taking round a hat, into which some bystanders were foolish enough to put sundry coins.

The summer holidays found me again at Lyndhurst, this time with Buckmaster, but perhaps it was too late in the season, for we did not do as well as I had done on my previous visit. Amongst a lot of *Amphipyra pyramidea* we got a solitary *Catocala promissa* at sugar. I remember that we were both much struck by the partiality of *Phycis fusca* (*carbonariella*), a coal black moth, for the blackened places where the heather had been burnt the year before, whereas we found *Crambus warringtonellus* and *C. selasellus* anywhere on heathy ground. We had a glorious time, but: "Don't forget before you pack up a lantern to empty it of oil." So say the stains upon my treasured interleaved copy of the "Manual" every time that it is consulted.

Mr. Wilson once took a party of young geologists from Rugby to see the museum at Warwick. In the train, Fison (now Sir Fred Wm. Fison, Bart.), a "big fellow" in the Sixth, and much venerated as our most promising "stinks man," remarking on the beauty of the country, said: "How much jollier it is nowadays with hedges and green fields than it was in geological times, all striped with red and blue and green, with nasty great slimy beasts crawling about!"

On the cold night of November 13th–14th, 1866, all in our house were roused at 1.30 A.M. by Mr. Wilson, and told to put on some clothes and great-coats and go into the garden to see the meteors. We were, it is to be hoped, both at the time and afterwards, duly grateful to him. Just as I reached the door some six or seven fine meteors were streaming together across the sky. These were quickly followed by others, singly or in groups, and for the twenty minutes or so that we were in the garden the sky was never clear of meteors for more than a few moments at a time. It was a quite marvellous sight, and although the learned said that the shower was not equal to that of 1833, certainly nothing since has come near to it. So great was the effect on the school that the new paper which appeared shortly afterwards was called *The Meteor*. If not always as brilliant as its namesake, its career was not so fleeting.

During 1866 there are many references in the diary to Trovey Blackmore, and one to a mutual friend and neighbour the late Mr. N. Tuely; moreover, the correspondence with Mr. Ed. Cooper

was still kept up. It was, however, in January, 1867, that I discovered two very near entomological neighbours, the Messrs. Blackburn. We soon became intimate friends, and their proximity and ardour as collectors caused them to dominate entirely my entomological life for several years. At about the same time Trovey Blackmore's health began to fail seriously.

Under the influence of Thomas Blackburn I began to collect beetles enthusiastically, but after a very few weeks found that it was not compatible with the ordinary school work, supplemented as this was by special preparation for Oxford. At about this time a letter appeared in *The Meteor* purporting to come from the pen of a neglected specimen in a small collection of insects in the Arnold Library, and signed "MOULDY BUG." My school-fellows at once decided that *I* was the author, and for the next year or so I was generally called "Mouldy Bug," or simply "Mouldy." The true author was, I believe, Mr. Arthur Sidgwick, one of the masters, and doubtless he thoroughly enjoyed the wrongly imputed authorship.

The Marlborough College Natural History Society (founded April 9th, 1864, by the Rev. T. A. Preston) had proved a great success, and was followed little more than a year later by the Harrow School Natural History Society. Mr. Wilson one day asked me to breakfast to meet the Rev. F. W. Farrar, then a Harrow master, the founder and life and soul of the latter society. As a result, the Rugby School Natural History Society was founded on March 23rd, 1867. Mr. F. E. Kitchener was the first President, the writer the first Honorary Secretary, and of the seven original ordinary members the most notable is the great hunter, Mr. F. C. Selous. At the first ordinary meeting the Honorary Secretary read a paper on "Insects: their Collection and Preservation," causing some amusement by producing from various pockets, like a conjuror, a complete entomological armamentarium. About a year later he compiled for the first volume of the Transactions a "List of the Lepidoptera (Butterflies and Moths) which have been observed within 8 miles of Rugby." It was a mere list of Latin names, without comments, and included Micros. A posthumous paper "On Caterpillars" was read after the author had entered the ranks of the Old Rugbeians. In the Society's "Entomological Album" will be found a note by the same hand on the larvae of four species of *Eupithecia*, which, while very similar in shape and markings, strikingly resemble in colour their very different food-plants, Heather, Ragwort, Angelica, and Wild Carrot. The larvae of this genus had at this time a great fascination for me.

My Rugby captures in 1867 included *Emmelesia decolorata*, *Scotosia vetulata*, *Anticlea rubidata*, *Macaria liturata*, *Eupithecia lariciata*, *Aventia flexula*, and *Hedya servillana*.

In the holidays I took *Adela cuprella* on Wimbledon Common, and *Macaria notata* in Coombe Wood, as well as *Biston hirtaria* in Hyde Park. Expeditions to Epping and West Wickham do not seem to have produced much result, but the appearance of *Pyrameis cardui* at Putney is notable.

An expedition to the Isle of Wight was chiefly devoted to thatch-beating for *Depressariae*. Later I went with my parents to Devonshire, my first visit to a county which has since become a second home. Among my captures were *Agrotis saucia* at sugar at Ilfracombe and Lynton; *Camptogramma fluviata*[1] at lamps at Exmouth, where I also met with *Sterrha sacraria;* thatch yielded *Depressaria ciliella*, *yeatiella*, *albipunctella*, and *badiella*. Among the insects that I did *not* take in Devonshire was "a large butterfly, dark brown, almost chocolate-coloured, with a broad white edge to all its wings," which my mother saw at Hele, near Ilfracombe, about the flowers of Red Valerian. Unlike its congeners, it did *not* revisit the same spot when I was there with my net.[2]

In this year, 1867, Mr. Blackmore had a serious illness, and it is my impression that from this time forward he did but little collecting in this country. Newman's "Moths" was now coming out; I viewed it with mingled feelings.

It is indicative of the impulsive enthusiasms of youth that whereas the diaries state that in the spring I had resolved to work at the *Tineina* especially, a similar resolution as to the *Tortrices* was made in the autumn. However, second thoughts were the more enduring and I remained faithful for the three years or so until I ceased to collect altogether. Indeed Buckmaster and I entertained the ambitious idea of writing a book to supersede Wilkinson's work, but this never took definite shape.

At Easter, 1868, I left Rugby and divided the next six months between working for Oxford and collecting. On Wimbledon Common I found *Adela cuprella*[3] common though very local, and also took there *Choreutes scintillulana* as well as *Anchylopera subarcuana (inornatana)*. Regent's Park was visited for *Biston hirtaria*. Once again West Wickham was not very productive; but Coombe Wood yielded *Notodonta dromedarius*, which I had not

[1] In those days common at lamps in the Wandsworth district.
[2] See *Entomologist's Monthly Magazine*, Vol. IV., p. 86.
[3] *Ibid.*, Vol. V., p. 77.

taken there before; moreover Buckmaster pointed out to me a larva of *Acronycta alni* on a hazel just outside the wood. At Darenth I took *Hadena contigua* at rest on a tree-trunk, also *Tortrix sorbiana* and two specimens of the local *T. semialbana*. Box Hill produced *Ellopia dolabraria*, *Lithosia rubricollis* (abundant among yews) and *Crambus chrysonuchellus*. To this day I have scarcely got over my disappointment at missing two of the lovely little *Leptogramma literana* beaten from oaks on Ashstead Common; it has a bad habit of darting to the ground when disturbed, and is almost as cryptic on the wing as at rest.

Several of these boyish expeditions remain with me as vivid impressions, but it was in July, 1868, that, to quote an old diary, "I spent the most glorious month of my life," with that perfect travelling companion, the late John B. Blackburn, in a peasant's cot at Camghouran on the shore of Loch Rannoch. To give my fellow collector's account:[1] "At the somewhat gloomy close of a fine day early in July, we left the road which borders Loch Rannoch, and crossed the rough fields which lead to Camghouran. We had reached the end of a somewhat harassing journey, and it was with feelings of intense satisfaction that we saw the collecting-cases and portmanteaux, containing all necessaries for a Scotch campaign, laid on the stone floor of our little abode. Our kind hostesses very soon put before us a meal, such as all who have visited Camghouran will vividly remember; and the sight of the newest of milk and the freshest of eggs[2] urged us to recruit before we turned out, as we had resolved to do, for a few hours' collecting on our first night.

"To one of us the scenery, and, better still, the insects, of the district were quite new; and, as we passed down the long barley-field beyond which lies the great sugaring-ground of Rannoch, the other set himself to combat the slightly gloomy impression conveyed to the mind by the grand mountain solitudes and sloping moors veiled partially, as we saw them now, by uncomfortable looking masses of cloud. Turning to the left, we reached two very different tracts of land separated by the high road: that next the loch being grass-grown, and covered with fine birch trees, while the other produces a mingled mass of heather, rushes, and fern, amongst which grow, singly or in clumps, birch, fir, and alder trees. Here, at nine o'clock, sunset had scarce faded from the sky: dark banks of cloud were still shot with vivid lines of light; the air was soft

[1] *Entomologist's Monthly Magazine*, Vol. V., p. 221.

[2] (Editorial note to original paper.) "Milch-cows and productive hens appear to have been imported since our experience in 1865.—R. McL.(achlan); E. C. R.(ye)."

and warm, and the loch lay motionless, almost at our feet. Some eighty trees, near the loch's edge, received an application of the sugar, and we retired among the heather and woods in the background to "moth" until the charm should have exerted its sway. Here a fine *G. papilionaria* crossed our path and was safely boxed, and somewhat peculiar forms of *B. repandata* occurred commonly.

"Darkness had come on by about a quarter to eleven sufficiently to warrant a first visit to the sugar; anxiously, and with darkened lamps we drew near to the first tree. Former experience told us that sugaring at Rannoch was not quite profitless. One held the net below the sweet track of bark, the other flashed a stream of light upon it; both peered with eyes as greedy as the most ravenous *polyodon*. A *Carabus* drew back, and politely stopped eating; two "daddies" buzzed off, and banged against the lamp; and a great snail seemed to be regarding contemplatively the shiny traces of his own ascent; but there were no moths.

"Tree No. 2 surprised us with a goodly sight. The brothers *tincta* and *occulta* absorbed sugar side by side, both in the loveliest of condition; *N. conflua*, *C. cubicularis*, and *X. rurea* dropped in to complete the party. At the next "spread" we found *tincta* and *nebulosa*, a lovely *H. contigua*, *R. tenebrosa*, and *T. pronuba*. This first night was, indeed, undeniably good. *Tincta* was common; *occulta*, of the deepest shade of blackness, and without a rub, not by any means rare; and a fair sprinkling of *duplaris*, *contigua*, *tenebrosa*, *festiva*, *conflua*, *cubicularis*, *rurea* (and var. *combusta*), *polyodon*, *adusta*, and *augur*. . . .

"Our sugaring continued to be good throughout the whole four weeks of our stay. For some time *A. tincta* and *occulta* were of frequent occurrence, and few insects, when in faultless condition, present a more striking appearance than the latter [but it is a somewhat ticklish moth to box]. *H. contigua* and *adusta* were not rare; *viminalis* came out in some numbers [towards the end of our stay]; of each of *N. neglecta*, *M. furva*, *C. haworthii*, *C. duplaris*, and *O. suspecta* [at end of the month], we secured a few specimens; and *S. anomala*, with the last traces of respectability rubbed out of him, one night surprised us by a visit. *R. tenebrosa* was common (and, as usual, far from fine), and *N. conflua* not scarce.

"The 'vulgar herd,' most of them constant attendants, comprised *N. augur*, *baja*, *C-nigrum*, *brunnea*, *xanthographa*, *plecta* and *festiva*; *X. polyodon* and *rurea* (both species represented by very fine varieties); *T. orbona* [remarkable forms] *janthina*, and *pronuba*; *C. cubicularis*; *A. porphyrea*; *H. pisi*.

"The following trespassers came to sugar:—*L. caesiata*, *C. russata*, *M. fluctuata*, *B. repandata*, *M. margaritata*, *R. crataegata*, *L. pectinitaria*, *C. populata*, *L. olivata*, and *H. elutata*."

To Blackburn's list of "trespassers" I may add the following micros:—*Tortrix fosterana*, *T. ribeana*, *Endrosis fenestrella*, *Grapholitha penkleriana* and abundance of *Paedisca solandriana*. My friend never alluded to the mammalia that were attracted, by our lamps rather than our sweets; possibly he thought they would be out of place in a journal devoted to Entomology, but I suspect wounded pride had something to do with it. The solitude of such a place as Rannoch may be a bit skeerie at midnight, and when one hears a large animal night after night gallop up and down in the long heather close by, one is disposed to draw near one's companion for security. The loud barking of the foxes in the mountains behind was scarcely reassuring. We christened the great unknown "the mad stag." Once, as Blackburn was squatting down to secure an insect in his net, he heard, as he thought, my step behind him, and looked up to discover the *deer* (for such indeed it was) looking over his shoulder! With a bound it disappeared into the darkness, and haunted us no more. But worse was to come. One night we were fairly driven off the sugaring-ground by a solid phalanx of big-horned black highland cattle! What could we do save retire in good order, walking backwards with lamps directed into the great beasts' glaring eyes?

Camghouran[1] (as it is spelled in the Ordnance Map) consists of a group of huts irregularly scattered over the hill-side, but the Robertsons who dwell therein call it "the toon." As a rule house and stable are under one roof, and that not too well adapted to keep out the weather, of which one usually gets so much in those parts. When the wind blew we felt the pattern of the stones in the walls by the narrow vertical and horizontal draughts which seemed to cut us into cubes. We slept in bunks, where a sheet stretched over some hay promised well, but if restless one was apt to get a good deal mixed up before morning. Our full postal address was:—

c/o Mrs. Robertson, No. 5,
Camghouran,
by Kinloch Rannoch,
Pitlochry,
Perthshire, N.B.

[1] Blackburn spelled the name Camachghouran, but the Ordnance Map gives Camghouran; it is pronounced Cam-a-ghouran—the *gh* a guttural aspirate. The natives call the district Ranach.

but a letter inscribed simply "To the flyman in Ranach" was delivered by the first post.

We did not give "light" much chance as an attracting agency, since we spent most of the short hours of darkness outside, nevertheless a specimen of *Agrotis lucernea* (which we suspected of designs upon our treacle store) once gave us a quarter of an hour's chase round the tiny room. The small window-panes were examined daily for the local *Oecophora similella*, Linn. (*stipella*, Doubl.) which associated with *Tinea pellionella*, *T.* (?) *fuscipunctella*, and *T. rusticella*, as well as remarkably fine *Endrosis fenestrella*, and an occasional *Aglossa pinguinalis;* however, we found the *Oecophora* more common in a neighbouring shed.

Our fare was simple, our appetites comprehensive. We brought a ham and a bag of oatmeal along with us, and had arranged for a periodical supply of mutton by the "machine," as the carrier's cart was not inaptly named. However the thirty miles jolting proved quite too much for the second joint, so we gave up mutton. Luckily there were plenty of eggs, and accordingly when we left for the South the chief item in our bill was "19 dozen eggs at 3d. the dozen."

One day we were honoured by a call from Capt. Robertson, of (I think it was) the Highland Light Infantry, a son or nephew of the Struaness of Struan—the great Lady of the place, who lived in "the beg hoose." As a result he was good enough to grace our humble board, and in honour of the great man our hostess provided three poached eggs each, instead of the usual ration of two. At this we fly-men greatly rejoiced, but the gallant officer, whose appetite was on the peace establishment, was amply satisfied with two eggs, and great was his amusement when Blackburn and I, having easily demolished our three eggs apiece, greedily tossed for a fourth, since we had no notion of letting his odd one go out.

For some time we were at a loss to make out what was the staple food of our Robertsons. Oatmeal, to our surprise, they had none; certainly they did not fare on mutton, for "braxy sheep" is a luxury rarely to be had, and they could not periodically feast upon the one small porker. Careful observation showed us that the chickens and the dog were both fed on potato peel, and that the said porker lived on potatoes. In fact our hosts were potato feeders, being too poor for oatmeal porridge or oat cake.

One day that same porker's screams rent the mountain air, and made me leave pins and setting boards to rush to his sty. There I saw Maggie, our cook, parlour-maid and house-maid, seated in the

sty upon a milking stool with the pig between her knees, the little animal squealing loudly as she scrubbed it with soap and water!

On grassy knolls within the precincts of "the toon," *Aphelia pratana* was as common as it is upon the South Downs. Among the frequenters of the patches of wood on the lower ground were many insects that are familiar to London collectors:—*e.g.* beating sallows by day drove out a few *Hypermecia augustana*, Hübn. (*cruciana*, Zett.), and *Eupithecia tenuiata*, while *Depressaria conterminella* flew over the same bushes at dusk; strongly marked varieties of *Grapholitha penkleriana* were to be found among alders; birches produced *Tortrix ribeana*, *Antithesia corticana* and *praelongana*, together with *Grapholitha paykulliana*, Fabr. (*ramella*, Linn.), and *campoliliana*, Treit (*subocellana*, Don.), these Tortrices were chiefly found on the birch trunks, but upon the twigs, *Argyresthia goedartella* and *retinella* fairly swarmed.

Stilbia anomala occurred freely on the moors and remained for three days in exquisite condition, after which it was almost over. It was best taken at dusk just beyond the houses. At the same time and place we searched ant-hills for *Tinea ochraceella* till our eyes watered with the emanations of formic acid; the moths crawl up the grass stems on the nests, but they were very scarce.

Erebia blandina (*aethiops*) was common enough in the open parts of woods, a male was taken with the fulvous patch on one forewing devoid of the usual spots; in the same places, especially on the slopes of Crois Craig, *Plusia interrogationis*, very variable and in exquisite condition, was to be found on dull days on stones and birch stumps. It was in searching for this lovely Noctua that I first seriously felt the disadvantages of my short and bad sight; Blackburn found many more than I did, and also picked up a fine *Hadena rectilinea* at rest upon a stump.

The Black Wood of Dâll was somewhat of a disappointment; its mighty pines, over twelve feet in girth, and dense growth of various species of *Vaccinium* and heath suggested all sorts of things. Among the pines we took *Ellopia fasciaria* (*prosapiaria*) and a few *Cedestis gysselinella* and *Gelechia galbanella*, while small dark varieties of *Tortrix fosterana* were not uncommon; *Fidonia brunneata* (*pinetaria*) was common enough but exceedingly local; *Sericoris daleana* (*alternana*) was also to be had. Towards the end of the month *Grapholitha geminana* flew in clouds over the *Vaccinium* in the sunshine, in fact I have rarely, if ever, seen an insect so abundant; sometimes eight or ten were in my net at once. We spent some hours walking up and down a piece of lush herbage near the road where Blackburn

had taken three superb specimens of *Sterrha sacraria* in the previous summer, but without result; we picked up, however, a few of the Rannoch Cetoniid *Trichius fasciatus* for Mr. (now the Rev.) Thomas Blackburn, and I fancy it was here, or in some other marshy land near the loch, that we found *Schrankia turfosalis.* It was certainly not far from this spot that, on and around two splendid Aspens (*Populus tremula*), we came across swarms of *Grapholitha cinerana*, variable, but without any trace of fuscous or ferruginous; I boxed 40 in a quarter of an hour!

Emmelesia ericetata (*minorata*) was very common in all directions, but for *E. blandiata* (*adaequata*) we had to make a pilgrimage to Kinloch Rannoch, but were rewarded, at any rate, with a few specimens; there we also found *Eupithecia succenturiata;* while on the way we came across a young Aspen which had many of its leaves spun together two and two, with a somewhat disgusting looking larva of *Cymatophora or* between them; we found about a hundred on that one small tree.

But all said and done *the* great expedition at Rannoch is that to Mount Grayvel.[1] The ascent begins at the cottage door, and the views gain in beauty and variety as one climbs up. As soon as the moor is reached *Acidalia fumata* and *Larentia caesiata* start from one's feet; both might well be said to swarm, but the number of the latter, mostly in perfect condition, was almost incredible; they rose in dozens from each rock as one drew near. Among heath *Eupoecilia angustana* was everywhere plentiful, with them we found a solitary *Eupoecilia* of which Mr. McLachlan said afterwards "it comes nearest to my *degreyana*, but the wings seem too short; I think I saw a specimen from Mr. Burney identical with yours." Among heath and fern we found also many small dark specimens of *Sericoris lacunana*, together with *Plutella cruciferarum*,[2] and very large examples of *Pleurota bicostella*. Now and again *Nemeophila russula* flew wildly past, while Blackburn found *Scodiona belgiaria* at rest among the heather. Larvae of *Lasiocampa callunae* were in some numbers, and those of *Saturnia carpini* not uncommon. Sweeping the heath yielded *Acronycta menyanthidis*. On such ground the lovely *Crambus margaritellus* was generally common, but *C. ericellus* was only picked up occasionally. *Phycis fusca* (*carbonariella*), as

[1] So Blackburn spelled it: the local pronunciation was Garra-vel. No such name occurs on the Ordnance Map, but where it should be found there stands Meall-Nan-Sac. Query, is one name Scottish, the other Gaelic?

[2] Mr. J. H. Durrant informs me that this familiar insect was described by Curtis as *maculipennis*, a name that has priority over Zeller's.

usual, was found among *burnt* heather, which reminds me that, on returning from one of our expeditions to the mountain, we came upon a small cup-shaped hollow near the burn overlooked by a group of grand old pines, it was filled with Ling which had evidently escaped all fires during the lifetime of the oldest inhabitant; we plunged into it, when to our surprise the ling closed over our heads! We did not catch much in that hollow, indeed it was no easy matter to penetrate the dense growth.

Where *Vaccinium* prevailed over *Erica* and *Calluna* we found a few *Mixodia palustrana*, and many *Coccyx ustomaculana*, together with a few of a *Lithocolletis* which we attributed to *vacciniella*, although Mr. Stainton said in a letter that the determination was "not free from doubt."

In the wetter parts of the higher moorland the Large Heath, *Coenonympha davus* (*typhon*), was abundant, and on the same ground (even up to 2000 ft.) *Nemeophila plantaginis* gave us many a headlong chase, in one case leaving the writer stretched prone upon the bog with great clatter of pill-boxes. In such places *Bactra* (?) *lanceolana* simply swarmed, but they were so small and highly coloured as to suggest that they could scarcely be conspecific with the large pale obscurely marked form that was to be found in the meadows by the loch side.

Near a burn below Grayvel we took a solitary *Coccyx taedana* (*finitimana*), and not far off a few *Coremia munitata*, which seemingly preferred stony ground. On the actual slopes of the mountain *Tortrix viburnana* was common, as indeed it was on the higher moors generally; on the same slopes at our first visit *Mixodia schulziana* was abundant, to be replaced later on by swarms of the pretty little *Pamplusia monticolana* (*mercuriana*).

The rugged summit itself seems to owe its virtues to the fact that its stony head is but sparsely clothed with grass and moss, in place of the denser growth of heath and bilberry with which its neighbours are covered. Hard work stumbling about on this rough terrain yielded a few specimens of *Psodos trepidaria* (*coracina*), an insect hard to see and harder still to catch. Small and dark specimens of *Sericoris daleana* (*alternana*) were to be had in plenty, and a very finely marked *Amphisa gerningiana* was secured. *Crambus furcatellus* was tolerably common, and we were fortunate in securing a fair number of *Scoparia alpina* (*paralis*), a distinctly "good thing." A few *Mixodia schulziana* also reached the summit, as well as the tiny *Lithocolletis* (?) *vacciniella*. Among the bilberries half-way up *Cidaria populata* was very abundant and *Scopula alpinalis* not uncommon.

"Descending, we visited a hollow on which the sun just then shed warm and friendly rays, and here *Erebia cassiope* (*epiphron*) sported to and fro in considerable numbers, its little black form being very conspicuous against the bright green grass."

With one of the "good things" of this classical locality, *Dasydia obfuscata*, we were somewhat disappointed, but managed to secure a few fine specimens. Mr. Blackburn obtained eggs and succeeded in getting a few of the larvae through the winter. It was somewhat tantalizing to cut out from one of the old birches on the sugaring ground the empty pupa-case of *Trochilium scoliaeforme*. Exactly where we got *Botys fuscalis* has escaped my memory, and the same is true of *Peronea caledoniana*, but *Ellopia fasciaria* flew rather freely at night in the neighbourhood of fir-trees, and *Larentia olivata* was found at rest as well as flying by the loch side at night.

As for larvae we got several of *Hadena adusta*, while sallows gave nourishment to a few *Notodonta ziczac*, and a fair number of *Clostera reclusa* and *Cerura furcula*. Certain larvae beaten from alder we took to be those of *Selenia illustraria*, but they presented a most curious variety of colouring: whether or no Mr. Blackburn reared them I cannot remember. He found a fine brood of *Dasychira fascelina* just emerging from the egg. I beat a larva from Rowan (*Pyrus aucuparia*) from which I ultimately bred a most lovely specimen of *Cidaria psittacata*.

During the last few days of our stay we spent some time collecting Tortrix larvae from birch and sallow, but more especially from *Myrica gale*, *Vaccinium vitis-idaea* and *V. myrtillus*. Those found on the two last-named plants would seem to have been terribly infested with ichneumons, whose larvae and pupae were common, together with Tortrix larvae, but most of the latter were *hors-de-combat*, healthy ones being very scarce. From such of the latter as we did find we reared during the next two months a number of *Peronea ferrugana*, nine *P. maccana* (off *Vaccinium*), one *P. lipsiana* (off *Myrica*), several *P. hastiana* and one *Phlaeodes crenana*.

Profiting by the melancholy experience of a "fly-man," who, on a previous occasion, had unwisely confided his store boxes to the tender mercies of the "machine," we trudged on foot, boxes in hand, all the weary miles from Camghouran to Kinloch Rannoch.

On our way North we had journeyed from London to Dundee by sea, and after thoroughly enjoying a good lunch in the Thames, were induced by the chief steward to compound for our food for the whole voyage. However, when we got well into the North Sea it began to blow pretty stiffly from the north-east, and continued to do

so. It was the longest voyage that I had made, and was, perhaps, the worst in my experience. Any way the mention or mere thought of food was but an intensification of a misery that was scarcely endurable. For my part, I reached *Punch's* second stage, when one fears that the ship will *not* go to the bottom, yet somehow Dundee was reached at last. Now we had taken very little money with us, and on the return journey a portmanteau went astray which necessitated posting in a dog-cart some twenty miles, a heavy tax on the slender balance in our pockets. The train from the North just missed the Dundee train at Perth—we saw our train moving out of the station, but were told that if we *ran* we could catch it at the next station! Accordingly run we did, cumbered as we were with precious store-boxes and setting-houses. It was a very hot August day, and the permanent way did not afford a good running ground. At first the train receded hopelessly, but we held on; anon we seemed to keep our distance, then to be gaining slowly. How hot, but how thankful, we were when the half mile or so was covered, and we found ourselves panting and exhausted in our third-class compartment! When we got on board our steamer at Dundee the head steward again suggested that we should compound for our meals, but with proud wisdom after our painful experience, we more or less politely declined. We cast off in perfect weather, which endured to the end of our voyage over a glassy sea. Naturally a month's hard work collecting day and night with truly simple fare had got us into splendid health, and given us the appetite of two young wolves. Meal followed meal with the usual nautical frequency, and we ate oft and gaily. Alas! the question of payment inevitably came up, and to our chagrin we found that the lost portmanteau had more than absorbed our surplus cash. Accordingly we had a long and sad discussion as to the relative expediency of having dinner *or* breakfast, for we could not afford both. What the decision was I forget, but whichever way the lot fell, the event entailed more self-denial than we found pleasant. At the docks we got into a cab having but a few coppers in our exchequer, and had to call at a friendly office in the city to borrow money to pay the fare.

Soon after our return from Scotland the Blackburns introduced me to the National Collection, then in the gloomy cellar at Bloomsbury, and my diary refers to the *Tortricina* therein as "in a most wretched state; *aceriana, dealbana*, and *ocellana* all muddled up."

I was extremely desirous to capture something new to Britain, and my chagrin was great indeed when Dr. Knaggs, after expressing

a strong opinion that one of my Rannoch Tortrices was "new" finally decided that it was nothing but an extreme variety of *Grapholitha paykulliana*, Fabr. (*ramella*, Linn.).

Mr. Stainton wrote me in reference to some Rannoch *Tineina:* "The insects in your box which have interested me most are Nos. 3 and 4, of which you say: 'Bred and beaten from ash. Larva olive colour, with brown dorsal stripe.' They are the dark variety of *Prays curtisellus*, which I have never bred, though I have often bred the ordinary white form. Many entomologists think the dark specimens ought to be a distinct species."

In England the heat of the summer of 1868 was unprecedented. It had the effect of greatly reducing the numbers of heath-feeding larvae on Wimbledon Common: another result, perhaps, was the occurrence of several specimens of *Pyrameis cardui* at Wandsworth, though it had also occurred there in the previous year. At the blossoms of Petunia in my father's garden in September, I saw *Sphinx convolvuli*, as well as another large Hawk-moth, which I thought at the time to be *Acherontia atropos*. That autumn I bred two specimens of *Peronea rufana*, Schiff. (*autumnana*, Hübn.) of the variety *bistriana*, from larvae taken on White-Poplar in Southfield, Wandsworth, between one and two miles from the old Wimbledon Common locality.[1]

In 1869 I had some very pleasant collecting at Forres, in Morayshire, with the late Mr. George Norman, of which an account appeared in the *Entomologist's Monthly Magazine* (Vol. VI., p. 214). Again my almost wild desire to capture a species new to Britain was disappointed. Some very distinct *Depressariae* attached to Broom, in which all the veins were marked with fuscous, and in some cases the thorax striped with the same colour, turned out to be merely a variety of the common *D. costosa*. However in this, perhaps at that time my favourite genus, I shortly afterwards had the pleasure of identifying as *D. cnicella*, Treit., some specimens taken on Hayling Island by Mr. Moncreaff among Sea Holly (*Eryngium maritimum*), the insect being then, so far as I know, unrecorded as British.

At Forres I found a larva on the Sweet Gale (*Myrica gale*) which I felt sure at the time must be that of *Acronycta myricae*, Guen. (*euphorbiae*, Schiff.), then undescribed. Accordingly I described it with great care, and hopefully watched it pupate, but alas! the imago never emerged. A description published a few years later proved that my conjecture was a sound one. While at Forres I

[1] *Entomologist's Monthly Magazine*, Vol. VI., November, 1869, p. 148.

busied myself with getting eggs of *Erebia blandina* (*aethiops*) for the late Mr. Wm. Buckler. After some fruitless attempts I was successful. A few butterflies were confined in a band-box covered with gauze containing also some of the food-plant (the grass, *Molinia coerulea*). The point was to keep the butterflies alive, and this I succeeded in doing by the simple expedient of inserting into their cage a damp sponge, at which they drank frequently. Water seemed to suit them better than syrup.

Earlier in the same year (1869) I again travelled on the continent, and it was in the Franconian Switzerland that I first saw Lycaenids drinking at a puddle in the road, many species together, including, I believe, among others *Lycaena minima*, Fues., and *L. arion*, Linn., the two extremes. The next year, in the Tyrol, I got near enough to a Purple Emperor when drinking to catch it in my hat! At Maidenhead, in the middle of an August afternoon during a heavy shower, I pill-boxed two Humming Bird moths sitting within a few yards of one another on a fence. I have always looked upon these as among my most remarkable feats of legerdemain.

At Oxford I joined the then moribund Oxford University Entomological Society, and the minute-book shows that I attended several of the meetings and took part in the discussions.

In my second term an accident cost me the sight of my right eye. It was not a great while after my recovery that I found the setting of some *Hydrelia unca*, taken in Headington Wick Copse, very trying to my eyes, the trouble being much increased by monocular vision. Ultimately with great reluctance I decided to give up collecting altogether.

At that time I had a considerable number of entomological correspondents, including Messrs Stainton, Knaggs, Buchanan-White, Buckler, Hellins, Moncreaff, Harper-Crewe, Porritt, Norman, McLachlan, and Mrs. Hutchinson of Leominster. Few of these, alas! are still living, but some of their letters still remain in my possession. In later years, towards the end of his life, I had much interesting correspondence with Barrett, chiefly about the larvae of *Eupithecia jasioneata*, with which I supplied him.

My first long voyage was in 1884, when I went to Canada with the British Association. I did no collecting but saw a number of *Vanessa antiopa* among willows near the Devil's Lake in the Rocky Mountains, also a specimen of *Pyrameis virginiensis*, Drury (*huntera*, Fabr.) busy at a flower bed near the Parliament Buildings at Ottawa; moreover I made my first acquaintance with *Danaida archippus*, Fabr. (*plexippus*, Linn.) on Hanlan Island near Toronto. When in the

Indian Camp at Blackfoot-Crossing as I was starting for a walk over the prairie with my friend Mr. William Barnard, a young brave, "Yellow Horse," ran up and excitedly tried to stop us. He was eloquent in the sonorous Blackfoot tongue, but for some time failed to make himself understood. At first I thought he was anxious to tell us not to go near the burial place of his tribe—if exposure of the dead may be termed burial. At last a sudden thought struck me; there were some ominous black clouds in the sky, nevertheless I thought it would not rain. Accordingly I made the sign for rain commonly used by the deaf and dumb in England followed by the Blackfoot negative sign, which I happened to know. Our friend Yellow Horse at once understood, smiled, indicated his disagreement, and let us pass on. *We* were right, the untutored savage wrong, it did *not* rain. The signs used were (1) pointing to the sky with fore-finger = weather, (2) a quick double shake of the fingers = rain, (3) the action of tossing a thing away with the right hand, as if worthless = negative.

A visit to Tenerife in 1887, and subsequent visits to Madeira and to Vesuvius, called my attention to volcanic phenomena. I reprint here an account of a winter ascent of the celebrated Peak, written at the request of Mr. Latimer (of the *Western Daily Mercury*), who was in the island at the same time as our party. On the lower parts of the island I saw for the first time alive *Pyrameis indica*, Herbst, and *Deiopeia pulchella*, Linn.—insects I was destined to see again far, far away. A note published at the time is placed at the end of this chapter. On the slopes of the Peak I saw many large beetles, sluggish black apterous creatures (*Tenebrionidae*; *? Blaps*, or *? Pimelia*). These, old Dr. Crotch told me, were benefited by the absence of wings, since it saved them from the risk of being blown away to sea. From the parochial point of view of a Canarian naturalist the theory was plausible enough, but how does it apply to closely allied insects on the Sahara, or on the Libyan desert?

Meanwhile, in 1879, I had bought a house at Mortehoe, North Devon, and from that time spent some portion of every year there. It was but natural that moving into a new locality aroused entomological thoughts, and I took to noting in my interleaved copy of "The Manual," such species as I from time to time came across. Yet I did no collecting on my own account, though usually carrying a net and a few pill-boxes. When, however, a Buckmaster, an Image, an Onslow, or more frequently a Dixey favoured me with his society, I rejoiced to have an excuse to sally forth at night with lantern and sugar-pot. Occasionally the Red Valerian (*Centranthus*

ruber), or the treacle-bedaubed gorse bushes yielded such things as *Agrotis ditrapezium*, *A. lunigera*, *Leucania unipuncta*, or *Polia xanthomista*. This led naturally enough to the printing of a local list in 1901, followed by new editions in 1903 and 1907.

It was in 1903, jnst before I sailed for India, that Dr. Dixey called my attention to certain bionomic questions, and the consequent value of observations on some of the very commonest insects. This proved to be a turning point in my life, for which I cannot be too thankful to him. Shortly afterwards I found that the distinguished entomologist, who succeeded Westwood as Hope Professor, was willing not merely to house in the great collection under his charge almost anything that I might catch, but what was in my case especially important, to get my captures set and so save any strain on my surviving eye. Thus it was that after an interval of over thirty years, at the mature age of fifty-four, I returned with renewed ardour to my boyish love. From this it results that the Hope Collection in the Oxford University Museum is now cumbered with over twelve thousand specimens of all orders of insects collected by me under the circumstances related in the following pages.

A SPRING ASCENT OF THE PEAK OF TENERIFE.[1]

Before leaving England we had decided to ascend the Peak, but on our arrival at Orotava we heard on all hands that it was impossible to go up on account of the snow. However, a preliminary reconnaissance from the Cañadas, or old crater, more than half way up, confirmed our impression that the difficulties were greatly over-estimated, and Dr. Crotch, the one Englishman in the place who knew the mountain well, reassured us. The ascent in winter is so rarely essayed that it is difficult to get an outfit. Alpenstocks could not be bought, but fortunately were to be borrowed from goatherds; nails to repair the gaps in shooting boots had to be specially made by the blacksmith (N.B.—They were such as were locally used for shoeing asses!); such a thing as a blue gauze veil could not be supplied by all the drapers and milliners in the town. Finally it was with difficulty that guides could be induced to attempt "El Pico."

At length, soon after 6 A.M., on March 12, we started, the three baggage mules laden with food, water, and wraps for the cold, and after a substantial meal we followed on horseback. Our party consisted of Mrs. Longstaff, her sister, Miss C. A. Dixon, Mr. R. A. Read, and myself, with two guides, two muleteers, and sundry boys in charge of the horses.

The route lay at first through small fields and terraced gardens, where flourished under a broiling sun vines and figs, guavas and bananas, the prickly pear (home of the cochineal insect), aloes, palms, the castor oil plant—here grown for a crop and not for ornament—and, suggestive of consolation for the same, oranges and sugar

[1] Reprinted from the *Western Daily Mercury*, 1887.

cane. The potatoes seemed as far advanced as those in England in June, and the young corn, more than a foot high, was enlivened with a pink Gladiolus growing in profusion.

Amidst these beautiful surroundings it was impossible to forget for one moment that Tenerife is but a volcano and nothing more. At starting, the pebbles by the shore were seen to consist of lava; the road is always a lava stream, the innumerable terrace-walls are built of lava; lava, basalt, scoria, pumice—the whole island is made up of these in various proportions. Sections displayed in ravines in many cases show the lower surface of a lava stream to have burnt to a bright red the ancient soil over which it flowed. Immense labour is required to produce agricultural land from such unpromising materials. The lava, from 4 ft. to 8 ft. thick, has to be broken up and removed, then the ancient soil thus exposed is cleared off, the lava put into its place and the soil on the top of it. Finally all this would be in vain, and no "Sack" or "Canary" could be produced without costly irrigation works. The one animal commonly seen is a large sombre-coloured lizard.

The gardens are soon left behind, and for hours we ride or walk over the endless lava streams which in bygone ages left the old crater through the Portillo del Taoro, and poured into the vale of Orotava; to our right rise the lofty crags of Tigayga, the Egyptian Vulture grandly soaring above them. The peculiar vegetation of the Peak is seen to advantage. There are scarcely any grasses or small plants; at first nothing but the tree heath, here from 4 ft. to 8 ft. high, though in the patches of the ancient forest still remaining it reaches a height of at least 40 ft.; then the *Adenocarpus*, a scrubby leguminous shrub of green hue; lastly a plant which is found nowhere in the world but on the Peak of Tenerife, between the heights of about 5000 and 9000 ft. above the level of the sea. This, the Mountain Broom (*Retama canariensis*), is a striking object; it is leafless, but in May produces a profusion of white flowers which are the delight of bees; to travellers it is invaluable, as it affords shelter, bedding, and firing, and we get soon to look on its grey-green clumps with affection. We hear, but do not see, the real "Canary" bird (*Serinus canariensis*) singing among its branches.

Soon after noon, at a height of 7000 ft., far above the white clouds that conceal our starting place, we pass through the Portillo into the ancient crater called the Cañadas. This is eight miles in diameter, and on the north-east, south, and south-west, is enclosed by precipitous crags, varying in height, but in one place reaching 2000 ft. above the plain. The boundary wall is broken here and there, as at the point we entered, but especially on the north-west, where devastating streams of lava have issued from time to time.

The guides want us to encamp in a bleak place where the wind sweeps round the cliffs of the ancient crater, but we decide to leave the riding horses there and push on on foot accompanied only by two baggage mules, the two guides, and a muleteer. After a trudge of two or three miles across the pumice-covered plain, the guides who followed us strike, and hitch up the mules to two bushes. So Mr. Read and myself have to go back and lead on the mules ourselves, wishing the guides "good-night." On this they skulk after us in a whipped-dog sort of fashion. At length we reach a spot towards the foot of the mountain, where some lava blocks on the side of a hillock and a few friendly Retama bushes afford a little shelter from the wind, while a patch of snow at a convenient distance ensures a water supply.

The guides, astonished at our energy, now appeared disposed to sit down and bewail their fate. But Mr. Read and I began immediately to build up with blocks

of lava a low wall to windward, the guides grudging such assistance as they rendered; the Alpenstocks were built into it, and a very tolerable tent made by stretching rugs over them. The ladies meanwhile busied themselves with cutting large quantities of Retama twigs for bedding, while the guides in a leisurely manner collected dead Retama, of which there was abundance at hand for firing. In two hours we had a really comfortable bivouac and a blazing fire. Without our assistance the guides and their beasts would have been miserable; the muleteer would not even melt snow for his animals, and was in truth a surly, lazy fellow. We supped at sundown and at once made ourselves snug for the night, and with such success that instead of being cold as we had expected we were all too warm.

A bivouac 8000 ft. up a mountain is too exciting a situation for sleep, and we soon found ourselves sitting up in a row looking at the stars and waiting for the moon to rise. The guides made no attempt to keep the fire going; this was left to their employers, who had, moreover, late in the night, to sally forth to replenish the scanty store of wood that their lazy improvidence had supplied. At midnight we roused the camp—the guides grumbling bitterly—and, after some food, were soon on the move in the brilliant moonlight. Easy gradients over pumice and small patches of snow took us in an hour and a half over the Montaña Blanca to the foot of the Pico del Teyde itself, and we began the ascent. A slight path led by zigzags up a steep slope of loose cinders,[1] at the top of which some huge blocks of lava constitute a resting place, where in summer the night is often spent, but which is now inhospitable owing to snow drifts. This spot, 9700 ft. above the sea, hears a name which shows the enterprise of our countrymen—Estancia de los Ingleses. Here the guides again rebelled; they said it was impossible to go further in consequence of the snow. Accordingly we took the furs and other wraps they were carrying, and again bid them good-night.

By this time the great rarity of the atmosphere at such an elevation told severely on one of the ladies, who was attacked with "mountain sickness." After every 200 yards or so she was compelled to lie down on the rocks; finally, both ladies were overcome with the cold of the strong north-west wind that nearly cut one's ears off, and produced an effect on the nose that no quantity of pocket-handkerchiefs sufficed to assuage. Further progress was impossible under the circumstances, and the four of us had to seek an apology for shelter on the lee side of a crag that might have afforded a perch for a pair of ravens, but gave most inadequate and angular accommodation for four human beings. However, we had to huddle together under such wraps as we had, and economise heat as much as possible.

In about an hour and a half the sun rose magnificently, and we rejoiced in all those glories of cloud and light which are peculiar to a mountain sunrise and defy description. Here and there the sea was visible through a sheet of clouds, and far, far below lay the Villa and the Puerto de Orotava. The heavy surf breaking on thirty miles of coast showed that the wind was not confined to the top of the mountain. To the south-east, among the clouds and scarcely distinguishable from them, appeared the mountains of Grand Canary.

On looking about us after sunrise we found that we were close to Alta Vista

[1] Though the coarser volcanic ejectamenta are commonly, and conveniently, termed "cinders," and the finer "ashes," it should not be forgotten that, since but little true combustion occurs in volcanoes, those terms are not strictly correct. Like slag, which some forms of lava and scoria closely resemble, most of the solids poured forth by volcanoes partake rather of the nature of glass, or porcelain. Lava is a generic term; basalt and obsidian ("volcanic glass") are species.

(10,700 ft.), the place where some five-and-thirty years ago Professor C. Piazzi Smyth lived with his telescopes for several months. A small wooden hut, belonging to a sulphur company, was snowed up and we failed to force the door, but a comparatively warm place was found for Mrs. Longstaff where she could at least lie down on the cinders in the sun, and the guides, who by this time had come up to look for us, were told to take care of her. Our party was now reduced to three—myself, faint with the cold and panting for breath; Miss Dixon, panting but otherwise well; and Mr. Read, fit for anything.

There still remained to vanquish 1,500 ft., and that the hardest part. We found as a rule the snow was the best going, but we had been warned by Dr. Crotch that the only real danger was that of falling into snow pitfalls and damaging one's legs among the blocks of lava or obsidian, the latter as sharp as glass. The truth of this danger we soon realized, and therefore as far as possible kept either on the snow or on the lava, avoiding the places where they were mixed. In a few places the snow slopes approached the consistence of ice, but, as a rule, they afforded good foothold. At 11,700 ft. we reached the Rambleta, an elevated crater, from which the terminal cone rises. Here Miss Dixon had to succumb, and was left on the sunny side of a rock, where she tried to imagine herself warm.

Mr. Read and I now tackled the final cone, El Piton, a pile of ashes[1] varying in height from 400 ft. on one side to 600 ft. on the other. At first we attempted to climb a snow slope, but the surface, unlike that of most of the snow, was of almost icy hardness, probably owing to the internal heat of the mountain melting the snow every day, while the intense radiation caused it to freeze again at night. The goat-herd's stout staff proved a very imperfect substitute for an ice-axe, and, a step giving way, Mr. Read had an involuntary glissade which might easily have been attended with disastrous results. We then abandoned that side of the cone and by making a short circuit ascended with the greatest ease a lava stream or dyke on the southern face, which afforded almost a natural flight of steps.

The exertion of climbing, the rarity of the air at 12,000 ft., and perhaps the exhaustion due to cold when sitting on the rock before dawn, nearly overcame me, and I only did the last few hundred feet with difficulty—but it was worth it all. We stood on a narrow ridge of light coloured rock, partly white, partly pink, forming a wall around the crater; this was shaped like a bowl held sloping, the western side being but twenty feet above the bottom, the eastern perhaps eighty feet, and on that side ending in a veritable peak, the extremity of the crag, which was fringed with ice, being no larger than the seat of a chair, but a chair that the keen N.W. wind made it hard to sit upon.

This was, then, actually "El Pico del Teyde," the "Peak of Hell," as the Guanches (aborigines of Tenerife) called it, and no bad name. I sat down to adjust my veil, and at once leaped to my feet—the ground was too hot to sit upon! On all sides hot vapour, charged with sulphur, issued from numerous small apertures like rat or rabbit-holes, their mouths fringed with beautiful crystals of sulphur. The air as it issued from these was as hot as that of a Turkish bath, and the next day when I showed some of these crystals to a lady she smelt them and said, "Does it not remind you of the Devil?" We saw a stone of some pounds weight which had, to all appearance, been blown out of its place that very morning by a new "fumerole" or blowhole.

It was at once evident that the volcano on which we stood could only be called extinct by a great stretch of terms. In 1705 it surrounded the town of Guimar

[1] See note above.

with lava streams; in 1706 it destroyed the flourishing town of Garachico, and filled up its harbour; and in 1798 there was a lava flow on its S.W. spurs; it has been emitting steam and sulphur continuously, at least since Humboldt climbed it in the last century, and is doing so now—some say more freely of late than formerly. Vesuvius was believed to be quite extinct until it burst forth and overwhelmed Pompeii. Who can say when El Pico will again resume active habits?[1] Within the crater are some abandoned works of a company formed in defiance of prudence and common sense to extract the sulphur and turn it to commercial purposes. We at any rate were rejoiced to hear that the irreverent company had collapsed. In spite of its internal heat there was snow in the crater, or rather ice, having the texture of white porcelain.

Of course, the view from the summit was very grand. The greater part of the island was visible, while over a sea of cloud we saw the sister islands of Palma and Grand Canary—Gomera, the nearest, was covered in a bank of cloud. To the west one looked right into the fine crater of Chajorra, 2,000 ft. below us, seemingly quite extinct, while in the cinder-covered plain beyond were scattered at least a score of small volcanic cones—one of them of a bright red colour.

The downward journey presented no difficulty beyond the inevitable jarring, shaking, and jolting involved in a continuous descent for several hours. Miss Dixon was found behind her rock quite refreshed, while Mrs. Longstaff, after several hours' sleep on her cinder bed, awoke to find the mountain sickness had left her. As in going up, the snow afforded the easiest path, but the guides, who in spite of our advice had no nails in their boots, were compelled to keep to the rocks. We found our camp, that had been so warm and comfortable at night, was not as well suited for a hot afternoon; the heat on the bare pumice was almost intolerable, while to make matters worse, the good-for-nothing muleteer had left all our food in the broiling sun, so that much of it was bad. He had melted no snow to renew our water supply, nor even made a fire against our return. The monotony of the long ride down the slopes of Mount Tigayga was relieved by a fine display of the phenomenon known as the "Spectre of the Brocken." Soon after dark the weary ride came to an end, and we got back to civilization and the comfortable fonda kept by the worthy Justo and Carolina, old servants of the Marquez de Candia.

The next day, to our surprise, we woke to find ourselves heroes, and were congratulated on all hands. The truth is there is no difficulty whatever in ascending the Peak in winter, but it is better to go without guides. These men are excellent fellows under their own conditions, but they do not understand snow, and they bear cold badly. It is only necessary to exercise common sense; to sound the snow constantly with the Alpenstock so as to avoid the frozen places; and be on the look-out for the one real danger, namely, falling through the small snow caves between the blocks of lava—these latter are very hard and sharp and easily injure knee and ankle—they almost destroyed our boots. It is therefore wise to keep as much as possible either on the open snowfields or on the lava ridges, and not to change from one to the other oftener than can be avoided. In summer it is possible to ride up to an elevation of 10,000 ft., but in winter only to about 8,000 ft., although it is difficult to imagine that there could be any pleasure

[1] In 1896 a small lava stream issued from some part of the mountain. Again at the end of 1908 a more considerable outflow took place between Chajorra and the sea. It is stated that the last great eruption of the principal cone was witnessed by Columbus when waiting for promised financial support from Spain previous to starting on his great voyage.

in riding (or rather in being *driven* by the guides) to the greater altitude. The animals are poor creatures, badly saddled and harnessed, overworked, and not too well looked after. It should be mentioned that none of the party were experienced mountaineers.

NOTE ON "THE SPECTRE OF THE BROCKEN."[1]

The Val de Taoro is bounded on the west by the crags of Mount Tigayga, which rise about 3000 ft. above it. This mountain is a spur of the Peak of Tenerife running down from the lip of the Cañadas, or old crater, towards the sea. For a considerable distance its northern slope forms a table-land, perhaps half a mile or more wide, sloping evenly and gradually towards the sea, and limited on the east by a cliff, which falls by a succession of crags to the valley or rather plain below. Along the top of this wall of rock, one of the paths to the Peak runs for several miles. On March 8th, 1887, again on the 13th, and also on April 5th, I passed along this path in the afternoon, an hour or two before sunset. The Val del Taoro was on each occasion covered with thin white mist, which did not extend appreciably above the top of the cliff, being probably so limited by currents of air. As we stood near the edge of the precipice looking over the valley, with the setting sun behind us, we saw our shadows projected on the thin mist; each shadow of course followed every movement of its owner (keeping for example excellent time to a reel), and on one occasion (March 8th) it was so sharp, that when I went through some cuts and guards of the sword exercise the shadow of my walking stick was perfectly clearly defined. I should say that the spectre varied in distinctness on different occasions and at different spots on the same day, the variations being evidently due to the varying density and changing form of the surface of the mist. A lady friend saw it again on April 12th, under similar circumstances in the same place, but it was then far less clear. When seen at its best the spectre was surrounded by a halo consisting of three complete sets of faintly coloured rings, the head of the figure being in the centre of the system. A blue haze surrounded the head and reached about to the shoulders; the colours followed in the reversed order of the spectrum, green, yellow, orange and red; the first red ring crossed the figure at its middle, then came blue again, and so on, the second red ring reaching about to the feet; outside this again a third reversed spectrum, the outside red ring extending about once and a half the height of the figure. Beyond this triple system of coloured rings, at a distance of perhaps 15° from the line connecting the spectator's eye with the head of the shadow, was an arch of white light, broad and faint, like a lunar rainbow, but sufficiently distinct. Each person could see the rings around his own spectre only, or that of a person standing very close to him.[2] It was extremely difficult to judge the apparent height of the spectre, or its distance from the spectator. It was certainly larger than life, perhaps three times as large; its distance might have been two hundred yards; but I regret that I did not pay especial attention to these points.

[1] *Quarterly Journal of the Royal Meteorological Society*, Vol. XIII., No. 64, October, 1887.

[2] In company with a scientific clergyman I was one day complacently contemplating my Spectre and chaffingly remarked: "I am a holier man than you, Padre, I have a nimbus." His prompt reply was: "My dear fellow, no one can see it but yourself."

The best account of the phenomenon that I have seen is in Glaisher's translation of Flammarion's "The Atmosphere;" but there is some confusion in the description of the order of the colours.

NOTE ON GUANCHE SKULLS.

A young Swedish doctor, demonstrator of Anatomy in the University of Uppsala, effected an entrance into a cave on the face of a cliff, which had served the Aborigines as a burial place. From this cave, which I revisited with him the next day, he removed about twenty-five skulls, which we carefully examined. Something like two-thirds of them afforded indubitable evidence that their owners had suffered from depressed fractures *which had healed during life*. Surely it is very remarkable that such a large proportion should have gone through such an ordeal. [The exact numbers I forget, but am confident that the proportion is not exaggerated.] It so happens, however, that the Jesuit history of the conquest of the Canaries, states that the fair-haired inhabitants of the Western Isles had a strange pastime. They would go out, it is said, in opposing armies, and have mimic (?) combats, hurling stones at one another!

It is probable that the cave in which these skulls were found had not been disturbed by man for centuries. From its roof, across the entrance, hung a veil of Maidenhair, *Adiantum* (?) *capillus-veneris* whose fronds measured a full yard.

ENTOMOLOGICAL NOTES.[1]

Mr. Jenner's statement that "partial migration . . . explains the occasional presence of great numbers (of insects) on the sea coast, as every movement in that direction is stopped, and the species becomes as it were heaped up there," was curiously illustrated by an occurrence that I witnessed in April, in the island of Tenerife. Behind the town of Santa Cruz, towards Taganana, stands a range of mountains with a strangely sharp crest. Near the summit the southern slopes are carpeted with a small Bugloss (*Echium* sp.) with brilliant purple flowers; on the north side of the ridge the ground falls suddenly away in precipitous crags, densely wooded with Laurels and Laurustinus trees, under the shade of which is the most exquisite fernery ever imagined. A strong wind was blowing from the north, which struck against the cliff, and was turned upwards by it; a large number of white butterflies, *Pieris daplidice*, I think, impelled either by curiosity, a love of adventure, or of the beautiful, or what-not, kept flitting up these purple mountain-meadows, and making for the wooded crags. Each as it reached the edge, all unsuspecting, was cruelly swept up into the air, to a height of thirty feet or more; after a brief struggle it succumbed to *force majeure*, came down again and patiently began anew the ascent of the slope. Here the "heaping up" was literally effected; *P. daplidice*, though common throughout the island, was nowhere so abundant as on this spot.

On a rubbish-heap outside the town of Puerto Cruz, and also in a *stubble-field* (cf. Stainton's "Manual," vol. i., pp. 143 and 150), I more than once observed the gently-fluttering, *Crambus*-like, flight of *Deiopeia pulchella;* on a tall, shrub-like spurge (*Euphorbia* (?) *piscatoria*) the grandly conspicuous larvae of *Deilephila*

[1] *Entomologist's Monthly Magazine*, 1887, Vol. xxiv., p. 158. The allusions are to communications from Messrs. Barrett and Jenner in the previous number.

euphorbiae were abundant in some places; on the snow-clad (in April) lava streams of the Pico del Teyde Mr. Wainwright took a specimen of *Colias edusa* at a height of nearly 10,000 ft.

I have seen *Sphinx convolvuli* several times in my garden at Mortehoe; it would not look at Verbenas or Petunias, but showed a great partiality to the more gorgeous flowers of Gladiolus. I can confirm *all* that Mr. Barrett says about its noble flight, and the ease with which it may be observed. [By standing perfectly still, the insects will visit flowers quite close to one, even sipping honey from a spray of White Tobacco held in the hand—nay, more, on one occasion a moth so employed was rudely thrust aside by a yet bolder individual!]

CHAPTER II[1]

India and Ceylon, 1903–4

What follows is an account of the entomological experiences of a "globe-trotter," that is, of a traveller whose main object was to take an all too rapid glance at the scenery, the peoples, and the architecture of the places visited, and whose route was planned with that object. That I was able to give so much time to collecting was due to the fact that, whereas my daughter and her companion felt the heat so much that they usually kept within doors from about 10 a.m. to 3 p.m., I, for my part, protected by a "sola topi" of the "pig-sticker" type, and a spinal pad to my coat, suffered no serious inconvenience from the sun's rays *so long as I took active exercise.* Indeed there can be little doubt that I must have been intended for a Salamander. Thus in the Red Sea at the end of September it had been very hot; the air had the hot smell of a Turkish bath; it was one continuous drip and trickle. Nevertheless I thoroughly enjoyed it, though most people complained greatly. An American, who appeared to be much distressed, when asked how he was getting on, replied: "Wa-all, I'm just thinking what a fool I have been not to be contented with reading about Shadrach, Meshech, and Abed-nego instead of coming here to see what it was like!"

I sailed from England in September, 1903, without the slightest intention of collecting, and started accordingly with no entomological outfit save half-a-dozen pill-boxes. Not only was I without net and killing-bottle, I was without books, and worse still, was in woeful ignorance of the Lepidoptera of the Oriental Region.

Finding it very hot at Bombay we took train for Simla the day after landing, and a little south of Jhánsi I was struck by the large numbers of bright yellow butterflies flying along the railway banks—certainly a *Terias,* in all probability *hecabe.* October 5th found us at Kálka, at the foot of "The Hills." Fortunately the new railway was not yet open, so we had to be driven up the 58 miles to Simla

[1] The greater part of this chapter first appeared in the *Transactions of the Entomological Society of London*, 1906, p. 61.

in a "tonga," or post-cart, by a wild-looking hillman who handled the ponies magnificently. To one fresh from Europe the sights on the road were truly marvellous: natives in divers strange costumes, or lack of costume, long trains of wagons drawn by handsome humped oxen, or by buffaloes, surely the most uncouth of all domesticated beasts; flocks of goats and herds of cattle; strings of pack-mules bedecked with red wool tassels, often with necklaces of turquoise-blue beads, but always tinkling with many bells, and, to crown all, long lines of solemn camels, always hideous, yet always picturesque and strangely fascinating. However, amid all these strange sights there was one other which interested me, if possible, even more; I mean the multitude, the variety, and above all the beauty of the Butterflies. The first sight of such a thing as the big *Hypolimnas bolina*, Linn., black, flashing with violet-blue, excited an emotion better imagined than described. At all events, the creatures took me fairly by storm: collect I must!

The resources of the bazár at Simla only produced a child's butterfly-net, a mere toy, scarce twelve inches in diameter and of a vile, pale yellow colour. Armed with this and a tin cigarette-box filled with triangular envelopes I took the field. To this scanty equipment was shortly added a cyanide bottle. It was two long months before the toy-net was superseded by an umbrella-net from Watkins and Doncaster. This last is a very convenient weapon for use in towns, or when travelling or sight-seeing. It is inconspicuous when rolled up, but can be quickly brought into action; it is, however, inadequate for serious tropical work. In Calcutta I purchased a large Y-net with jointed canes, and had it fitted to the end of a landing-net stick made in two pieces that were six feet long when joined. A fair-sized net is required for large and swift butterflies, while for the many that habitually fly high and settle far from the ground, six feet is none too long for a stick, though in narrow woodland paths it will be found unwieldy.

Subsequent experience in many lands has taught me that the strain caused by a sudden swoop with a large net is quite too much for the sticks usually supplied by the shops. Messrs. Hardy Brothers, of Alnwick, and 61 Pall Mall, have fixed for me a specially strengthened Y upon the middle joint of one of their steel-centred, cane-built, salmon-rods. For general purposes this has done me excellent service; the butt end may be attached when required, giving a stick of six feet, which I find to be as long as I can manage. Mosquito netting, dyed green,[1] is far more serviceable than leno,

[1] This can be obtained at the Army and Navy Stores.

owing to its superior power of resistance to thorns. It is well to have in one's portmanteau, several spare bags, and I always travel with two sticks, and have an umbrella-net as well, for use in city gardens and on like occasions. A collector going to a remote place should be thoroughly provided, or grievous disappointment may result at a critical moment.

In common with most collectors I pinch all butterflies except Blues and Skippers, which I prefer to box, or bottle. Mr. Otto Möller, of Darjiling, told me that he found it best to pinch all butterflies, even the smallest. Chloroform I find the most convenient death agent, but there is something to be said for ammonia, and much for cyanide.[1] All butterflies, except the larger Skippers, travel

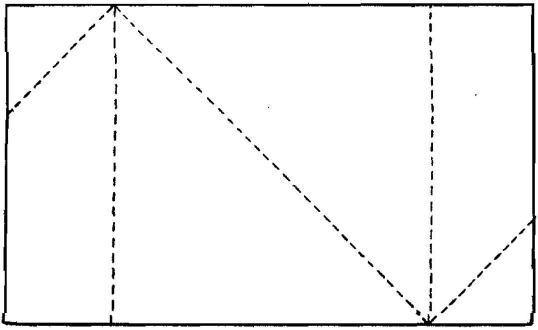


FIG. 1.—Butterfly envelope, creased but open.

best in three-cornered envelopes. The diagrams [Figs. 1 and 2] show the method of folding, and *if increased by one-fourth* would be a useful size. Larger envelopes are requisite for Papilios, while smaller suffice for Lycaenids. The number, date, locality and remarks may be written neatly on the envelope; when the insect is set these *data* may be cut out, folded if necessary, and placed on the pin beneath the specimen as a permanent record. The *data* should be copied daily into a quarto note-book ruled in convenient columns, with index-numbers corresponding to the specimens. Note-books should be strongly bound, but must open well; the paper should be of the best quality so as not to "dog's-ear." They can be made and ruled to order by a

[1] If grasshoppers are killed by chloroform their hind-legs are apt to come off as the result of spasm.

good stationer; I get about half-a-dozen books at a time; it is convenient to have 25 lines to a page, and each book should give space for 2000 specimens. I usually prepare my note-books, entering the index-numbers, on the voyage out. A wholesale stationer will cut the papers of required sizes for a very small charge. It is well to order some thousands at once, of three or four sizes—the largest number of the size mentioned above. The paper should be of medium stiffness, unglazed, slightly absorbent, yet suitable for writing upon. I make it a practice to fold, each day, those that will be wanted for the morrow, so that nothing should delay the desirable early start. Skippers, stout-bodied moths, Micros, and flies are best pinned, but in travelling make a point of *always* carrying boxes containing pinned specimens *yourself*. Smaller beetles and Aculeates

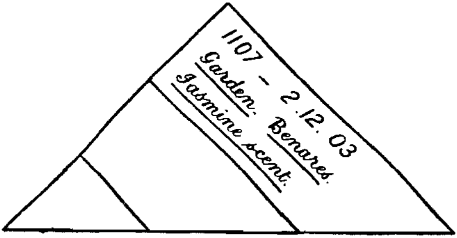


FIG. 2.—Butterfly envelope, folded.

may be put in screws of tissue paper, bearing the *data*. Orthoptera may be made into rolls like cigarettes: it is easier to tie up such rolls with Berlin-wool than with cotton or string, as it does not slip. Remember always that good *data* are almost as valuable as the specimens to which they are attached, some think even more so.

The envelopes containing butterflies are best packed in cigar boxes (wooden, never tin[1]); such as hold fifty cigars are of a convenient size. They should be packed just tightly enough not to shake about, and a small quantity of naphthalene crystals put in each box. The boxes should be wrapped in brown paper, with label tied on; moreover the labels should have some cotton or linen basis so as not to tear easily when wet. I either register or insure (for 5*s*. each parcel)

[1] Insects sent home in tin-boxes are very liable to mould. Some collectors, in especially damp localities, have found it necessary before packing insects to dry them artificially (over a lamp).

according to the postal regulations of the country; that is well worth the small extra charge. It is as well to carry with you from England labels, *good* string, brown paper and sealing wax, since it is often difficult to get these things, especially brown paper. By adopting these precautions I have never lost a consignment, and have had but one box seriously damaged in the post. Surely when the cost of a long voyage is considered, it is unwise in the extreme to be in any way mean in the after treatment of one's captures. By sending home frequent small consignments the risk of loss or damage is divided. The brass dropping-bottles for chloroform supplied by Messrs. Watkins and Doncaster are very convenient. A reserve of chloroform[1] should be carried in larger metal bottles, but care should be taken *not to fill them too full*, or the expansion of the fluid in the tropics is apt to burst the bottles. Forceps and other special apparatus should be carried in duplicate.

Very nearly all the insects taken in the voyages herein described have been added to the Hope Collection in the University Museum at Oxford, and the note-books relating to them will ultimately go into the Hope Library.

Naturally in a rapid tour of this kind, much of the time spent in towns, there was small probability of turning up anything new, but it is hoped that some of the observations made (even on the commonest species) may throw a glimmer of light on some of those questions of Bionomics which are now attracting the attention of naturalists.

I. INDIA.

Simla, lat. 31° N., alt. 7200 ft.

In reference to the seasonal variation of many species it may be remarked that at Bombay on October 2nd and 3rd there was heavy rain, the tail-end of the monsoon. It was held to be a very late season, the rain had lingered and the cold weather was delayed.

My collecting at Simla was confined to a riding expedition along the old Hindustán-Tibet road. This is an excellent riding-path, patted down as it is by the bare feet of the natives and the great pads of the camels so as to afford a smooth surface such as is seldom seen in mountain roads. The track follows the watershed of the Sutlej and Jumna, cut at one time on the hot and dusty, almost treeless, southern side of the mighty ridge, where the terraced slopes

[1] Chloroform bought at the best druggist in Carácas would scarcely kill large moths; apparently it had been diluted with alcohol.

are covered with crops of maize, or ruddy millet; anon crossing to the cooler northern side which is mostly clothed with fine forest of Spruce, Deodar, Holm-oak and Rhododendron—thus winding in and out, but for the fifty miles that we traversed always maintaining an altitude of from 7000 to 9000 ft. Yet so deep are the valleys, so steep the hill-sides, that we scarcely got a glimpse of either of the mighty rivers between which we marched.

From an entomological point of view the most important flowers were a brilliant but small Ragwort, several kinds of Golden-rod, a pale mauve Cineraria, and two straw-coloured Thistles: one of them, tall and slender, was especially attractive to butterflies; the other was a very decorative plant with Acanthus-like leaves and large globular heads. From the gardener's point of view, however, the most striking plant that we saw was the crimson-flowered *Potentilla atrosanguinea*, which was especially common under the shade of the Deodars, as on Jakko Hill; some seed sent home proved fertile and has stocked several gardens. Some of the Rhododendrons formed huge trees with trunks over twelve feet in girth.

We went by way of Fágu, Theog, Matiána and Narkanda to Bághi, returning by the same route, except that from Bághi to Narkanda we walked over Mt. Huttú, 11,000 ft.[1] The expedition occupied eight days, but for simplicity of description I shall not distinguish between outward and return journeys.

The general aspect of the country was decidedly autumnal; the nights were chilly and most flowering plants had gone to seed. There was more cloud than usual, and there were occasional slight thunder-showers. Most of the butterflies seen appeared to have been out some time, and were much battered. Two circumstances (besides the embryonic net) tended to restrict the bag: one, the fact that collecting was for the most part confined to a narrow mountain road, bounded by a precipice on the lower, and a cliff upon the higher side; the other, a limitation of wide application, that a tropical sun is not conducive to rapid pursuit.

SIMLA, alt. 7200 ft., to FÁGU, alt. 8200 ft.

October 10th and 17th.

Gonepteryx rhamni, Linn., var. *nipalensis*, Doubl., was abundant throughout the journey, and so was *Aulocera swaha*, Koll., though in very poor condition; both occurred in Simla itself. The latter is

[1] In Indian names "á" is pronounced as "a" in father, "ú" as "oo" in boot "a" or "u" as "u" in but.

a Satyrid, having on the upper side a resemblance to our White Admiral, flying also with much of the grace of that favourite butterfly. It loves open spaces in woods, returning to the same spot when disturbed. When it settles on the ground, a rock, a flower, or a tree-trunk, it often leans over on one side as much as 45° or even 50°. I saw one of these butterflies make three successive efforts, getting further over each time. On two distinct occasions I watched a butterfly settle twice, turning the first time over to the right, the second time to the left. I think there is no doubt that this "list" makes the insect less conspicuous when settled.

Pararge schakra,[1] Koll., is another common roadside butterfly in the Simla district; it closely resembles our *P. megaera*, Linn., but is larger. *Chrysophanus phlaeas*, Linn., var. *timeus*, Cram., was also common; *Colias fieldii*, Ménét., is sufficiently like our *C. edusa* to pass readily for that species; *Polyommatus baeticus*, Linn., is also suggestive of our South Downs, where it has been seen occasionally; the same may be said of *Argynnis lathonia*, Linn., var. *issaea*, Moore. Again, *Pyrameis indica*, Herbst, is very like our *P. atalanta*, Linn., though not so handsome and scarcely as graceful in its movements. So far there was plenty to bring to mind the fact that we were still within the Palaearctic Region. There were, however, a few insects to suggest the close proximity of the great Oriental Region, for if *Atella phalantha*, Drury, is very like a Fritillary (at least as seen from above), and *Ilerda sena*, Koll., closely resembles a Hairstreak, on the other hand the under-side of *Belenois mesentina*, Cram., is decidedly more brilliant than our Whites, while there is no denying that *Precis* (*Junonia*) *orithyia*, Linn., is quite Oriental in its aspect. This insect had struck me with admiration at Solon on the way up to Simla, and is called by the school-boys of India's summer capital, "The Ladies' Fancy." With the habits of a *Vanessa* or *Pyrameis*, there is something about the shape of the wings, the prominent ocelli, the brilliant blue of the hind-wings, and the leaf-like colouring of the under-side which gives this butterfly a very tropical appearance. However, I soon learned to look upon it as amongst the most familiar butterflies of Northern India. At Fágu it was common, but like most butterflies which have a proclivity for settling on the ground, not too easy to catch.

At FÁGU another butterfly of quite European aspect was common, *Vanessa kashmirensis*, Koll.; this is no credit to its name, looking like an *urticae* that had been born and bred in the "Black country."

[1] Should not this be *shakra*?

But the Chalcosiine[1] day-flying moth *Agalope hyalina*, Koll., elegant in shape and quiet in colour, its wings white, shaded with grey towards the tips, ochreous at the base, was quite a stranger.

FÁGU, alt. 8200 ft., to THEOG, alt. 7400 ft.

October 11th and 16th.

Before our start in the morning I found abundance of *Chrysophanus pavana*, Koll., in dry weedy corners of cultivated ground; this is sufficiently distinct from *C. phlaeas*, but has no especial oriental glamour.

From the ground by the roadside I picked up a large newly-emerged Bombyx with the awe-striking name of *Trabala vishnu*, Lefevre; it proved extremely tenacious of life and got a good deal damaged in the killing, as there was no oxalic acid available. Two Blues, *Cyaniris vardhana*, Moore, and *Zizera maha*, Koll., var. *diluta*, Feld., together with the Hairstreak, *Ilerda sena*, completed the bag for this stage.

THEOG, alt. 7400 ft. to MATIÁNA, alt. 7700 ft.

October 11th and 16th.

At THEOG, our first halting-place, *Gonepteryx nipalensis* was especially common, and here I took my first *Athyma opalina*, Koll., a Nymphaline resembling on both upper and lower surfaces *Limenitis sibylla*, Linn., an insect to which it is closely allied both in structure and habits.

On the road, besides *Ilerda sena, Chrysophanus pavana, Precis orithyia*, and *Argynnis issaea*, several things turned up. Of *Pyrameis cardui*, Linn., a fresh brood appeared to have emerged on the 15th or 16th October, and was common at the flowers of a straw-coloured thistle. I saw a few more *Athyma opalina*, and secured one. In their elegant floating flight one seems to see through the white markings of the butterflies of this genus. The Simla school-boys call them "Sailors," but to me the name "Ghosts" would seem more appropriate. They settle on the leaves of trees or shrubs, rarely affecting flowers. Here I got my first *Precis lemonias*, Linn., an insect with the habits and structure of a Vanessid, but with much the appearance of *Pararge aegeria*, Linn. A specimen of *Terias libythea*, Fabr., taken on the return journey, bears the note "easy to catch," which

[1] Sir George F. Hampson regards the *Chalcosiinae* as a sub-family of the *Zygaenidae*.

• is true, but at the time I do not think that I distinguished it from the much commoner *T. hecabe*, Linn., which it closely resembles.

At MATIÁNA the only new insect found was *Huphina nerissa*, Fabr., of which I took two specimens, both males. This is a somewhat glorified *Ganoris napi*, Linn.; one of the specimens appeared to have a slight scent which I could not describe, but certainly it was not that of the male *napi*.

Perhaps the most abundant butterfly at Matiána, and indeed throughout the woods of the district, was *Cyaniris singalensis*, Moore (very like our *argiolus*); it was in poor condition, flying about the tops of tall shrubs, but not seeming to affect either ivy or holly, although both were there.

Pararge schakra was especially abundant at Matiána and on the road thence to Narkanda. It differs from our *P. megaera* in being larger and having more conspicuous ocelli, though these are variable; one of my specimens, a female, having the ocellus near the tip of the fore-wing far larger than the rest. In its habits this insect sometimes reminded me of *P. megaera*, sometimes of *Satyrus semele*, Linn. It abounds along roads and in bare places, alighting almost always on the earth or on rocks, with its wings expanded like *megaera*, but when it settles down to rest the wings are raised, the fore-wings drawn back within the hind-wings, and all that remains visible is the colour of dust. In no case did I see it turn on one side as *S. semele* does, but three times observed it settle with its back to the sun, so as to reduce its shadow to a mere line; unfortunately I made this observation towards the end of my acquaintance with the butterfly, so was unable to make sure whether this was a mere chance or a definite habit. At any rate, I did not observe any instances to the contrary. I suspected in *P. schakra* the existence of a very slight sweet scent, that appeared to be unlike that of any other species.

At Matiána a number of Geometers were beaten out of alders, three *Philereme variegata*, Warr., and one *Cidaria niphonica*, Butl.; they had a jerky flight, which saved many of them from capture. One night a Deltoid, *Hypena tristalis*, Leder., came to light.

MATIÁNA, alt. 7700 ft., to NARKANDA, alt. 8800 ft.

October 12th and 15th.

Many of the same insects were met with as on the previous stage, but the following may specially be noted; *Terias hecabe*, my first specimen of the commonest species of a very characteristic Indian

genus; *Ganoris canidia*, Sparrm., a White like *P. rapae*, Linn., but with bigger black spots; and *Belenois mesentina*, flying fast and going straight ahead in a purposeful manner. Here I may remark that the swift flight of the Whites generally has much impressed me; it is evidently closely related to the fact that they are quite the most conspicuous of all butterflies, especially at a distance. *Argynnis issaea* was again well to the front; another *Athyma opalina* was securely "papered," and a specimen of *Precis lemonias* was taken, in which the anal angle of both hind-wings had been bitten off nearly symmetrically.[1] Amongst many of the *argiolus*-like *Cyaniris singalensis*, one *C. vardhana* was taken. Three Geometers, *Philereme variegata*, *Docirava aequilineata*, Walk., and the familiar widely-

a

b

FIG. 3.—Mutilated butterflies:—(*a*) *Mylothris trimenia*; (*b*) *Colias marnoana*.

distributed *Polyphasia truncata*, Hufn. (*Cidaria immanata*, Haw.), complete the list.

The dák bungalow at Narkanda is delightfully situated, nestling in the woods it looks right upon "The Snows." The cawing of rooks in early morning brought to our minds thoughts of home, soon to be dispelled by seeing birds near as large as thrushes, some bright green, others of the brightest crimson, as well as blue magpies (?) with two very long tail feathers.

At NARKANDA *Argynnis issaea* was in great numbers in the woods, so was the Chalcosiine moth *Agalope hyalina*; this flies fast and always in the same direction, this afternoon it was up-hill and against the wind, more especially up certain gorges in the mountain side. It was hard to catch, and on the wing looked much larger than it

[1] Not long before this observation was made, Prof. E. B. Poulton, F.R.S., had called the attention of entomologists to the indirect evidence of attacks by birds and lizards afforded by mutilated survivors. He referred to Fritz Müller's observations on the subject as far back as 1868, which were supplemented and confirmed by Mr. G. A. K. Marshall's very numerous later observations in South Africa. When both fore-wings, or both hind-wings, bear similar and symmetrical injuries, still more in those rare cases where all four wings are symmetrically mutilated, it is practically certain that the insect must have been at rest with its wings over its back when the injuries were inflicted. *Trans. Ent. Soc. Lond.*, 1902, p. 366. [See Fig. 3.]

is, but on settling vanished suddenly, burying itself in the herbage. *Colias fieldii* was common, but was not remarkable for swift flight.

NARKANDA, 8800 ft., to BÁGHI, 8900 ft.

October 13th.

The road traverses a magnificent forest made up for the most part of grand Spruces, their boles often 6 feet in diameter, with few and short branches. Many of them supported a species of *Ampelopsis*, (very similar to the familiar Virginian Creeper), now just beginning to turn red, but so lofty were the trees—at the very least 100 feet—that none of the creepers could get more than half way up their towering stems. Under the trees was a profusion of ferns, but at this season of the year the road was too dark and chill to be the haunt of butterflies, so I had to content myself with the grand vegetation, and the occasional inspiring glimpses of "The Snows," lying far away beyond the deep valley of the Sutlej, over which one might occasionally see, among many Kites, the lordly Eagle.

BÁGHI, 8900 ft., over MT. HUTTÚ, 11,000 ft., to NARKANDA, 8800 ft.

October 14th.

BÁGHI, our furthest point, is but 26 miles W.N.W. of Simla, though by the winding mountain road it is fifty. Here I met with *Neptis astola*, Moore, thus making my first acquaintance with that beautiful but difficult genus. The steep footpath up Mt. Huttú, when it has attained an elevation of a little more than 10,000 ft., emerges from the forest on to a flowery clearing that bore evidence of former cultivation. Here I saw *Colias fieldii*, *Atella phalantha*, and *Argynnis issaea*, and here also I took two specimens of *Parnassius hardwickii*, Gray,[1] one worn, the other in beautiful condition; above it is a lovely creature, but the underside has a curious resemblance to oiled paper. Delicate looking though it be, it is strangely tenacious of life. The concurrence of a Clouded Yellow, a Queen of Spain, and an Apollo was very suggestive of the Alps. All too soon the path plunged again into the now somewhat scrubby forest to come out finally, at near 11,000 ft., on to the grassy, flower-bedecked plateau in which the mountain culminates.

The highest peak was of course crowned by a Lhá To, or "Spirit-of-evil pillar," a cubical structure of stone which brought to

[1] See Plate I., Fig. 4.

mind the High Places of Baal. Such are to be found on any easily accessible peak, and more especially at the top of every pass, or Kótal. From a pole stuck into a chink in the stones there usually flies a small flag, on which prayers may be inscribed, though more often it is a mere rag. The pious—or it may be conscious-stricken—mountaineer here offers, with muttered prayer, a handful of flour or rice, and adds a rag to those adorning the neighbouring bush; in rare cases he goes so far as to offer a brass pot, or "lota." This was indeed a fitting place to appease the unseen powers of nature! There, far away to the North, and extending for scores of miles to East and West, lie the everlasting "Snows." But between us and those white-crested mountains lies a mighty sea of ever-changing blue and purple; a sea in which the hollows of the waves are valleys through which run mighty rivers, the crests are mountain ranges the equals of the Alps—for the snow we see is all above the 16,000 ft. level, and some of yon peaks touch 23,000 ft. Truly it is well described by one word, Himálaya, "The Abode of Snow."

The troops of butterflies seemed to rejoice in the glorious panorama. The brilliant *Argynnis issaea* was common, and the dingy *Vanessa kashmirensis* quite abundant—possibly some of the more distant white peaks to the left arise from its name-place, Kashmir. *Colias fieldii* was also in large numbers, a female exhibiting a symmetrical injury to the hind-wings very suggestive of a peck by a bird. *Precis orithyia* was there too, but *Aulocera swaha* was conspicuous by its absence, though we had seen it at Bághi, down below. Of a Humming-bird moth, *Rhopalopsyche nycteris*, Koll., much smaller than ours, I netted three specimens, one at the flowers of a *Delphinium*. The little *Herbula cespitalis*, Schiff., reminded me of home. The Blues were represented by *Cyaniris singalensis*. A male *Terias hecabe* was of the wet-season form. I noted that this species is very easy to catch, and is brilliant on the wing; also that when settled on a shrub or flower it is usually extremely conspicuous, but not so when it chooses as its resting-place a certain low plant with oval leaves fading to a yellow tint; then the rounded form of the wings greatly aids its concealment. An old English friend, *Euxoa corticea*, Schiff., was taken flying in the sunshine. I had several exciting chases after a big yellow Swallow-tail, and eventually secured one—my first *Papilio!* It proved to be our *machaon*, Linn., var. *asiatica*, Ménét. Here, as in Japan, it scorns fens and dykes, glorying in mountain tops. On the way down to Narkanda several *Pyrameis indica* disputed the path with our party.

The great resemblance to European forms presented by the bulk

of the butterflies seen in this expedition cannot fail to strike the reader.

During this expedition I met a very interesting man, a German Moravian Missionary, who was taking his little boy of seven to Delhi, on his way to school in Europe. He had been living for eight years at the foot of the glaciers, just on our side of the Tibetan frontier. Before that he had spent five years at a mission station where it was so cold, that he was cut off from all letters and newspapers for four or five months every winter. At his present station he occasionally meets an English official, but with that exception and the members of his own family, we were the first Europeans that he had seen for months. He greeted us eagerly in broken English and was quite delighted to find that I understood a little German. He was accompanied by a party of about a dozen natives of the mountains whose long black hair gave them a wild look. The Moravians, it would appear, have several stations in these frontier states where they have been at work for some fifty years, during which time they have made 100 converts. What marvellous perseverance, what invincible faith! My friend told me that these mountaineers, in their own homes, showed no trace of caste customs, but as soon as ever they came in contact with Hindus, his Buddhist servants fell into groups which would not take water the one from the other.

SOLON, *circa* 5000 ft., to KÁLKA, 2184 ft.

October 20th, 1903.

Starting from Simla by starlight, soon after 5 a.m., before the kites were up and stirring, we got to Solon by breakfast-time, and I there caught at 9 a.m. my first butterflies, two *alsus*-like Blues, *Zizera lysimon*, Hübn., f. *karsandra*, Moore, and *Z. maha*. Also two flies, a *Musca* of the *domestica*, Linn., group, and an Anthomyid.

On the drive from Solon to Kálka, by making the most of stoppages to change horses, and by occasionally jumping out of the carriage, I managed to secure quite a lot of things. Among the commonest was the beautiful *Precis oenone*, Linn., and with it *P. orithyia* and *P. lemonias*. Of *Atella phalantha*, *Belenois mesentina*, and *Ilerda sena*, I took single examples. *Terias laeta*, Boisd., was rather common. There were also *Catopsilia pyranthe*, Linn., the *gnoma*-form, *Terias hecabe*, and *Huphina nerissa*. About two miles above Kálka, say at about 2700 ft., I got a single *Precis iphita*, Cram. At about the same place the great catch of the morning was made,

for I took my first *Hypolimnas bolina*, three males and a female, believing them at the time to be two species. Why does not this glorious insect retain its far more poetical and more appropriate name, *Diadema jacintha*? Surely a black butterfly 3½ inches in expanse with four large glancing-blue spots, one on either wing, deserves to be called after a gem. Anyway, I shall never forget the impression produced by my first sight of its truly oriental splendour; it was like Kingsley's "At last!"

On my way down I also saw *Pyrameis indica*, and missed two Papilios, probably *P. machaon*.

Two Buddhist Pilgrims in yellow robes, shading their shaved heads by an umbrella, brought Kim vividly to mind, while that common sight in India, a man carrying a bed upon his head, explained and illustrated a familiar text.

At KÁLKA I got nearly two hours' collecting late in the afternoon; it was partly on waste ground about the station, but mainly in a field bearing a crop of some kind of pulse with thin pods 4-5 inches long.

A black and brown Cantharid beetle, *Mylabris sidae*, Fabr., was flying about flowers in the sunshine in large numbers. The genus *Precis* was represented by *orithyia* and *oenone*; the genus *Terias* by *hecabe*, *laeta*, and quite a number of *libythea*. The inevitable *Atella phalantha*, never very common, and *Belenois mesentina* were to the front again. *Ganoris canidia* was fairly common; I noted that a male had a "snuffy scent." Single specimens of *Ixias marianne*, Cram., and *Huphina nerissa*, both males, were taken. Of *Catopsilia pyranthe* I took two females, one of which had suffered a symmetrical injury to both hind wings. Three or four *Hypolimnas bolina*, both sexes, were disturbed in their first sleep, and being drowsy fell an easy prey. The Blues were represented by several species—*Zizera maha*, *Z. otis*, Fabr., var. *indica*, Murray; *Catochrysops cnejus*, Fabr; and *Nacaduba ardates*, Moore. Two Pyrales, *Zinckenia fascialis*, Cram. (*recurvalis*, Fabr.), and *Bradina admixtalis*, Walk., and a worn Acidaliid were picked up. A Sphinx, *Nephele hespera*, Fabr., was taken during the afternoon at the flowers of a *Bryonia*. A little later on, a Lymantriid moth, *Euproctis lunata*, Walk., came to the lamp of the railway carriage, to which a Sphinx, probably another *N. hespera*, also paid a momentary visit.

PESHÁWAR, lat. 34° N., alt. 1165 ft.

October 22nd–25th, 1903.

This city is finely situated in the extreme north-west of the great plain of the Panjáb, or Five Rivers; the mountains of the Sufid Koh and the foot-hills of the Hindú Kúsh bounding the view to the west and north respectively.

In its ancient mud fort, with wall within wall and elaborate flanking defences which make it quite impregnable to infantry and field-guns, we saw a large number of partially manufactured cannon belonging to the Amir, which had been impounded by the British Government when on their road to Kábul. He had tried to smuggle them through without permission, but calculated without his host.

In the bazár our ladies were greatly impressed by the magnificent appearance of the men, Punjábis and Afridis, especially by the fiery-red beards of those who had been to Mecca [Hajji]. Lime produces a fine colour, but there is an intermediate green stage which is decidedly not imposing. An old grey-haired man, whose beard has not been dyed for several weeks, presents a most strange appearance.

Owing to the kind offices of a magistrate friend we had an opportunity of seeing the house of the chief carpet-merchant of the city. It was very sad to find that the drawing-room of a man who dealt in all the beautiful fabrics of Kashmir, Kábul, Bokhára and Persia was filled with the tawdry rubbish of Paris and Berlin.

In the hotel garden I took a few things; *Terias hecabe* was common, two of them lacked "the dog's head mark."[1] *Belenois mesentina* was represented by a solitary male. One of three males of *Ganoris canidia* yielded a decided scent, hard to describe but certainly not that of *G. napi*. That dingy Skipper *Parnara mathias*, Fabr., was abundant at the flowers of Duranta. I missed several specimens of a yellow *Papilio*, probably *demoleus*, Linn., and possibly also *P. alcibiades*, Fabr., or one of that group. Of the Blues a *Polyommatus baeticus*, and three *Zizera karsandra* were taken.

Two moths came to light, *Oligochroa akbarella*, Rag., and *Earias insulana*, Boisd. (*tristrigosa*, Butl.).

Near the waterworks at BÁRA, amidst a wilderness of stones, I netted a female *Belenois mesentina*, three Blues, *Tarucus theophrastus*, Fabr. (two males and one female), and my first *Teracolus*, a female *vi*rida, Boisd. Dr. Dixey tells me that he had no idea that this

[1] In a typical specimen the black border of the fore-wing is so scalloped as to make the outline of the yellow ground-colour resemble a dog's head. When the border is narrow this appearance is lost.

species ranged so far north. A strange-looking long-nosed Grass-hopper, *Tryxalis nasuta*, Linn., seemed well adapted to its stony desert surroundings.

From Peshâwar my most interesting expedition, from every point of view, was to Ali Musjid in the Kháibar Pass. This tiny white building, said to be the first Musjid (Mosque) erected in India by the invading hordes of Mohammedan conquerors, stands in the middle of the valley about 2400 ft. above sea level.

On either side are the forbidding crags which Pollock's infantry surmounted in 1842, and so forced the pass, making the relief of the gallant Sale a comparatively easy matter. In front, perched high aloft on a hill that seems to close the valley, is the fort which Sam Browne reduced with his 40-pounders in 1878. Naturally we longed to go further, to see what there might be beyond that turn of the road where the valley narrows to a gorge. However I had not gone ten yards when the ringing voice of a sentry on the rocks to the right made me hesitate; the next moment an orderly ran down and exhibited a board whereon were written in diverse tongues the most peremptory orders against moving one step beyond the Musjid. It was hot and glaring. My daughter sat down to sketch. A few yards on the other side of the sacred enclosure was a green patch of vegetation beside the small stream which, clear as crystal, was full of frogs and tiny fish, and its banks fringed with a profusion of a species of Mint over which many butterflies were sporting. It was with difficulty that I persuaded the soldier to let me traverse those few yards; however, by letting him see me catch a butterfly, and letting him smell the cyanide bottle, he was somewhat pacified. I could not speak Pushtú, nor even Hindustáni, so was probably a Russian spy. Soon other sipáhis came down: each one insisted on smelling the bottle in turn: each saw a butterfly succumb to the fumes, and to each I tried to explain that the bottle would kill anything, even a Russki! To each the process of papering was demonstrated. The result was that I was permitted to move on perhaps 100 yards, and then they got quite excited at the chase. Soon a number of them indicated by signs a desire to be photographed. They stood in a row, and when all was ready I gave the word "'ten-shun!" They instantly sprang up. I pressed the button, and then said, "Stand at—ease. Stand easy." They were obviously delighted—saying "Achchha" (good). Then the word was passed round that I knew the words of command and was therefore a pakka Sáhib, and no Russki. Presently I had to photograph another group, and they finally insisted on my writing down all their names and

ranks. Never have I met with more jovial and good-natured barbarians than these men of the Kháibar Rifles, who twice a week guard our side of the pass as far as Lundi Kótal. Yet I was assured that any of these men, Afridis, would have thought nothing of shooting me!

And now for the Butterflies. *Danaida chrysippus*, Linn., was fairly common. I took two males and two females, one of the latter with pale ground-colour of an umbreous tint and much shading along the costa. *Pyrameis cardui* was the commonest butterfly, mostly in fine condition. I took one *Ganoris brassicae*, Linn., of the form *nipalensis*, Gray, a female, and saw several *G. canidia*, all of which had possibly strayed from a patch of cultivated ground hard by. The Clouded Yellows were represented by several *Colias hyale, auct.*, form *erate*, Esp. The beautiful *Precis orithyia* was quite abundant; *P. almana*, Linn., also occurred, but was not common. I saw several *Terias hecabe*. The Satyrids were the most interesting of all. A specimen of *Yphthima bolanica*, Marshall, was my first acquaintance in that elegant and delicately-made genus. *Hipparchia* (*Nytha*) *parisatis*, Koll., a handsome insect suggestive of *Vanessa antiopa*, was rather common, but unfortunately much worn. Very conspicuous on the wing, it did not appear to be attracted by the Mint, but usually settled on the ground, and was then very difficult to see. I also secured two specimens (both females) of a very distinct pale Satyrid, much the colour of *C. pamphilus*, but far larger and with dentate hind-wings, *Epinephele davendra*, Moore, a species that proved to be new to the Hope Collection [Plate I., Fig. 1]; I caught two *Polyommatus baeticus*, but saw no Skippers.

Three of that widely-distributed beauty, *Utetheisa* (*Deiopeia*) *pulchella*, Linn., were seen flying in the sun, and with them a brilliant little Burnet, *Zygaena kashmirensis*, Koll.

Among the outsiders were a Grasshopper, *Poecilocerus pictus*, Fabr.; a Beetle, *Clinteria confinis*, Hope; two Bees, *Bombus simillimus*, Smith, one of each sex, and a Wasp, *Vespa auraria*, Smith, a worker.

After about two hours the caravan from Kábul came down—long strings of camels together with mules, asses, and a few horses—bringing all sorts of produce from Afghanistán and Bokhára. With the animals were many weird men, women, and children, some clad in sheepskins (with the wool inside), others in some stuff of a light greenish blue that was most picturesque. A very little later and the northward-bound caravan made its appearance: again long strings of heavily laden camels, both the common sort and the two-humped Bactrian species—all alike bearing large packs of

Indian or European goods. The men accompanying the beasts were all armed, for the northern part of the pass, in charge of the Amir, was felt to be less secure, and an uncle or a cousin might be lurking behind any rock bent on doing his part in the hereditary family feud. Hardly had the last camel turned the corner when the pickets of the Kháibar Rifles came streaming down from their sángars (or little stone shelters) on every side, and we were given peremptory orders to retire. The troops marched back to their quarters and we drove rapidly towards the rich plains of India down the road that so many conquerors have followed since the days of Alexander the Great.

In the early morning of the day on which we left Pesháwar one of the ladies of our party was awakened by a report. The watchman, or cháukídar, of a bungalow close by had been shot while endeavouring to stop a thief!

These watchmen who guard every house, are said to be recruited from a caste of thieves. In India one does not pay a thief to catch a thief, but to keep thieves away. It is related that once upon a time an officer fresh from England, when engaging his servants declined to have a cháukídar. More experienced officers told him that he would be robbed if he did not. He said that he slept with a loaded revolver under his pillow, and he would like to see the thief that would dare to touch his things. This pleasure he was denied, for when he woke in the morning, he missed his watch, his money and his revolver. Nay further, he found that his wardrobe was limited to the pyjamas he had on! Under these distressing circumstances there was but one thing to be done, so he sent his servant with a note to the C.O. explaining that it was not possible for him to appear at early morning parade. Later in the day, a sadder and a wiser man, he engaged a cháukídar.

The Gházis, or Mohammedan fanatics, are a constant source of danger along the frontier, for from time to time one of them, impatient for the joys of Paradise, will "run amuck" and kill the first European that he chances to meet. One such incident was not without a grimly humorous side. The wife of a Sergeant-Major late one winter afternoon was walking in the outskirts of the Pesháwar cantonment, when a Gházi rushed up and stabbed her. The assassin was caught and in due course tried and hanged, but he was a disappointed man. In the gloaming he had mistaken the sex of his victim who was clothed in an ulster and wore a "bowler" hat of the manly cut then in vogue among women. But, look you, to ensure prompt admission to Paradise it is requisite that you

should have killed a Christian *man*, for women, having no souls, do not count!

MALAKAND, lat. 34° 30′ N., alt. *circa* 3000 ft.

October 28th and 29th, 1903.

By the kind hospitality of the Assistant Political Officer, Capt. R. W. E. Knollys, I was enabled to get two days' collecting at this remote frontier post.

MALAKAND is approached by a narrow-gauge military railway which leaves the main line at the important Cantonment of Nowshera and passes Mardán the head-quarters of the famous Guides. Where this railway crosses a river the railway station and fortified bridge-head are one, the tickets being served out through a gun embrasure. On reaching the terminus at Dargai (not to be confounded with Dárgai where the desperate fight took place) we were met by Capt. Knollys who, though politeness itself, struck me as being just a little stiff. Accordingly I addressed him thus: "I am afraid, Sir, that I must plead guilty to being a globe-trotter, but venture to urge two extenuating circumstances." He replied, "Indeed, Sir, and what may they be?" To this I answered, "I am *not* a Member of Parliament, and I am *not* going to write a book to set you all right." From that moment he was cordiality itself. Evidently this explanation had taken a load off his mind, for he led me to understand that not very long before he had suffered many things at the hands of a travelling M.P. We found out afterwards that he actually had vacated his house for us and was sleeping in a tent in his own compound. If our host took me for a Member of Parliament, the native troops took me for a Bara Sáhib[1] of some sort, probably a judge, for the sentries always presented arms to me, and once the guard turned out. Of course this was highly gratifying to one who had never reached a higher military rank than Captain of Volunteers.

Perched on a saddle, about 3500 ft. above the sea where the old Buddhist road crosses the foot-hills, looking forward over the Swát valley, and back over the dusty plain of the Panjáb, this isolated fortress affords a picture of rocky desolation. It has been the scene of much fierce fighting. We stormed it in 1895; in 1897 it was so suddenly attacked by swarms of tribesmen that our officers, hastily summoned from their game by the bugles sounding the alarm, fought all night in their polo kits, and indeed the situation was

[1] *i.e.* Great Master.

barely saved by the prompt arrival of the Guides from Mardán, who had started within the hour of getting the news and marched throughout the night. Even now the Pass is closed every night by *chevaux de frise,* and the garrison is always prepared for an attack. Moreover, when scrambling over the hillsides, in addition to the usual Indian thorns in all their varieties, wire entanglements have to be negotiated.

When we drove with our host through the peaceful looking Swát valley to the outlying fort at Chakdurra we had as an escort a sowar (trooper) of the Swát Levies, armed with both lance and sabre, and when I went collecting it was deemed prudent that I should be accompanied by a gigantic *chaprássi,* a Pathan of the tribe of the Jusufsai, or Sons of Joseph—for they claim to be one of the lost Tribes. My cicerone had fought against us in 1895, since which time he had served in our native army, and was now a Commissionaire or Official Messenger. I fear it tried his loyalty sorely to have to wait upon a mad catcher of flies.

The rocky hills seemed too dry and burnt up to harbour many Butterflies, but on the parched slopes of the fortified crag, nicknamed Gibraltar, the pretty little *Melitaea trivia,* Schiff., was almost abundant; on a glaucous shrub at the foot of the same hill were numbers of the glaucous green and yellow Grasshopper, *Poecilocerus pictus,* which though conspicuous enough on the wing was decidedly cryptic when at rest. Other Orthoptera were *Quiroguesia blanchardiana,* Sauss., and *Tryxalis nasuta.* I took also three Wasps, two *Vespa velutina,* Lepel. (var. "*des Indes,*" Sauss.) ☿, and a *Polistes hebraeus,* Fabr., ♀.

In addition to the above a long and hot walk only yielded one *Ganoris canidia,* ♂; two *Terias hecabe,* a female of the variety without the "dog's head," and a large but otherwise normal female; two Blues, a *Zizera karsandra,* and a *Z. maha,* var. *diluta,* Feld.; one *Precis orithyia;* a dingy Skipper, *Gegenes nostrodamus,* Fabr., and a Micro, which Lord Walsingham says is *Eretmocera impactella,* Walk., the variety with smaller spots; it belongs to the *Hyponomeutidae.* Some puddles of water at the baggage-mules' drinking-place proved very attractive, yielding a female *Argynnis hyperbius,* Johanss. (*niphe,* Linn.), a male *Tarucus theophrastus,* and the conspicuous *Hipparchia parisatis.*

The next day (Oct. 29th) I lighted upon an oasis in the desert in the shape of the staff-sergeant's garden, where irrigation had produced a brilliant mass of flowers, some vegetables, and a small field of Lucerne. Here butterflies abounded: *Terias hecabe,* without the

"dog's head mark," was in plenty among the Lucerne as well as at the Marigolds; the Lucerne also yielded both *Colias fieldii* and *C. erate*, the eastern form of *hyale*. Among the Danaines *Danaida chrysippus* was common, and *D. plexippus*, Linn. (*genutia*, Cram.), abundant at the Marigold flowers, at which also one *Tirumala limniace*, Cram., was taken. *Athyma perius*, Linn., was rather common, but preferred the wet mud left in the irrigation channels to any flowers. *Argynnis hyperbius* was also common, but had more refined taste, and was usually taken on the Marigold beds; its female was observed during life to resemble *D. plexippus*. *Precis almana* was common, *P. orithyia* very abundant at the same flowers, together with a few *P. oenone*, one of them very fine and large. As usual in India *Atella phalantha* and *Belenois mesentina* put in an appearance, the first at Marigold, the second, a male, among the Lucerne. The Hairstreak *Ilerda sena* occurred alike at Marigold and high up on the mountain-side. The flowers of *Gaillardia* proved more attractive than the coarser Marigolds to the smaller fry; the brown Skipper, *Parnara mathias*, was in abundance, so were the dingy Blues, *Zizera karsandra*, and *Z. maha*, but the latter and its variety *diluta*, preferred mud to any flowers.

Other small things were *Polyommatus baeticus*, and the Skipper *Gegenes nostrodamus*, which was common at the flowers of *Gaillardia* and Marigold; unfortunately I secured but two specimens, probably because it is a dull and unattractive insect. Two or three *Melitaea trivia* also turned up at these favourite flowers. Not far from the garden I took two more *Hipparchia parisatis*; this as before did not appear to be much attracted by flowers, but settled on the ground where it was very inconspicuous. I observed it lean over from 20° to 30°, and even saw it walking about with a "list" of 20°.

At Malakand we had the good luck to be just in time to see the fag end of the ticklish and much dreaded operation for the annual relief of the Chitrál garrison. Indeed at Simla I had heard the Adjutant General say that some day the whole column would be cut up. This year the risk was considered greater than usual, and to support the relief marching up and the old garrison marching down, two battalions of infantry, a battery, a few cavalry, and many sappers with a train had been moved up to Chakdurra, 10 miles beyond Malakand, and the last post on the road to Chitrál, which stands in splendid isolation 100 miles further. The troops we saw were a regiment of Panjáb infantry (either the 24th, or 25th), Bengal Sappers and Miners, an immense mule train of baggage and ammunition, and the 2nd battalion of the 4th Gurkas. The North-West men

were fine, tall, mostly handsome and comparatively fair, but the swarthy little Gurkas interested me most. In striking contrast with the Hindus they are a merry race. Very like Japanese, but darker, a trifle bigger and a trifle better looking. Undeniably very, very smart. I was introduced to some of the native officers, to whom a few complimentary phrases were interpreted. All wanted to be photographed. The dread kúkri, the special weapon of the Nipálese, was exhibited and to the great gratification of the owner handed round to the ladies. "Battalion!—'ten-shun!" They fall in and march off, played out by the very creditable band of the Sikh regiment which forms the garrison of Malakand. Each company came to attention with remarkable smartness as they passed the group of officers standing near us.

Lahore, lat. 31° 35′ N., alt. *circa* 700 ft.

October 31st—November 4th.

At the capital of the Panjáb which, though a city of the plains, was perhaps as picturesque as any of the Indian cities visited by us, my chief collecting ground was the extensive Lawrence Garden. This though full of flowers is so wild in parts, that, not to mention a Mongoose, I even came across a Jackal at midday; it skulked guiltily away like a whipped hound. On days when the band plays it is a great sight to see the police in their handsome uniforms mounted upon camels high above the crowd. Unfortunately, however, we missed *the* great sight of the place, the wife of the Lát Sáhib [1] driving camels tandem!

The class of Butterflies found at Lahore differed widely from those met with at Simla and further north, the predominant forms being Oriental. Here I first captured *Papilio demoleus*, Linn. (*erithonius*, Cram.), the "tailless swallow-tail," which I had perhaps seen at Peshâwar; this butterfly has a wide range in India and might almost be termed abundant, frequenting especially the flowers of *Zinnia*, *Lantana*, and *Bougainvillea*. When feeding it settles for a few moments only, fluttering with its wings the while; then it is not hard to catch, but when rushing from place to place it is quite otherwise. In colouring it is very like *P. machaon*, but far less handsome; the yellow ground-colour is often quite pale and bright when the insect is fresh, but it usually turns much darker and duller; cyanide very possibly hastens this process. It was at

[1] Literally Lord Master; the title by which the natives designate the Lieutenant Governor.

Lahore also that I first came across another very common Indian butterfly, *Papilio pammon*, Linn.; its graceful form and flight and rich velvety-black coat at first excited me so much that I had great difficulty in catching it.[1] Naturally enough I followed Linnæus in taking the sexes for different species: he called the male *pammon*, and the very different female *polytes*. At Lahore it especially affected the flowers of *Bougainvillea speciosa* and a shrub with blossoms similar in colour and scent to, but much larger than, those of White Jasmine. Like *P. demoleus* it flew rapidly from flower to flower and fluttered while feeding. The female taken here was of Wallace's Form II. (*polytes*); among the males was a sombre variety with scarcely any orange on the under-side of the hind-wings.

Danaida chrysippus was abundant, more especially at the flowers of *Asclepias* (the food-plant); amongst them was a dwarf female. *Tirumala limniace* was scarcely common.

Of the Brimstone-like *Catopsilia pomona*, Fabr., I only netted one female, but believe I saw others; it visits flowers high up on trees. *C. pyranthe* was abundant; it flies fast and high and is hard to catch; it was fond of settling on the flowers of *Duranta plumieri*, Jacq. on the tops of high hedges, forming a pretty contrast with the lilac-blue racemes. This is one of the many plants belonging to the Natural Order *Verbenaceae* which I have noticed to be especially attractive to insects.

Terias hecabe, both sexes, was fairly common; it flew slowly and near the ground. The black and white *Teracolus puellaris*, Butl., was also fairly common; perhaps it owes its name to the child-like simplicity of its dress. It flies near the ground, but so jerkily as to be somewhat hard to catch, and, moreover, has the habit of flying *into* bushes, by preference those well provided with thorns, and not coming out again. Of the dainty *T. protractus*, Butl., I could only get two specimens; its salmon-pink colour with broad black margins dusted with blue-grey make it one of the most beautiful little butterflies that I came across; its dress is all in exquisite taste, the under-side being a quiet greenish-yellow that must greatly protect it when at rest. [See Plate I., Fig. 3.]

White butterflies were not much in evidence; I took a somewhat worn female of *Appias libythea*, Fabr., also two *Belenois mesentina*, both females. This last is another common Indian butterfly; its upper surface reminds one of *P. daplidice*, Linn., but the underside of the hind-wings and tips of the fore-wings are bright orange with

[1] See, however, Chapter X., § 7, for my subsequent experience of the swift flight of this butterfly.

brownish veins. Experience at Lahore confirmed me in the opinion that Whites of all sorts are most difficult to catch; they are shy, and fly rapidly with a jerky vertical movement. But then Whites are by far the most conspicuous butterflies, especially when at a distance, and doubtless they need their swift wings. The Catopsilias are nearly as conspicuous as the true Whites, and they fly even more swiftly.

Among the Nymphalines the widespread *Atella phalantha* was represented by a few specimens at Marigold flowers. *Precis orithyia* (an insect that is apt to suffer much loss of beauty from grease) was not common, and the same is true of *P. almana;* a few of each were taken at flowers. At *Zinnia* flowers I got my first *Hypolimnas misippus,* Linn., a male; it impressed me as a most tropical-looking insect, though not so gorgeous as *H. bolina;* it had both hind-wings clipped, possibly by a bird.

The Blues were represented by two species—the neatly-marked *Tarucus telicanus,* Lang, common at the blue flowers of *Plumbago capensis,* and the little greyish-blue *Zizera maha,* abundant at the flowers of a species of Millet and some herbs of the Labiate family; amongst them was a specimen of the var. *diluta.* Blues swarm in India; many of the species are small and dusky, so that they are hard to follow on the wing, and their flight is even more jerky than that of Whites. They are often found on grassy banks as at home, but are especially addicted to water-drinking and are constantly present in irrigated fields and gardens. It must be confessed that the abundance of bigger game often led me to pass them by. Again, Blues when killed are apt to fold their wings the wrong way, and it is difficult to set them right again; but if kept in the bottle a short time only with a view to preventing this untoward result, they are apt to recover and fly away when the paper is opened while examining one's captures after the day's work.

The dull-coloured Skipper *Gegenes nostrodamus,* was common in the gardens, but I only took one female. Small moths, mostly Pyrales, were abundant in a patch of long grass and herbage in a damp spot. One of these was *Pyrausta incoloralis,* Guen., another the very widely-distributed *Marasmia trapezalis,* Guen.; but by far the commonest was the pretty little black-and-white *Zinckenia fascialis,* very suggestive of our *Ennychia cingulalis,* Linn. Among the Pyrales was the tiny Gold-tail, *Porthesia xanthorrhoea,* Koll. (*marginalis,* Walk.), which was flying in the sun.

Two things, besides the numerous green Parrots, especially impressed me about the Shah Dara, Jehangir's mausoleum. One

was the dignified figure of the Sheik, who is the official guide, and the way in which he proudly rolled off the sonorous Persian of the inscriptions. In the North-West to know Persian is pretty much what it is to know Sanscrit further East, or to know Greek in Europe.

The other thing was to see the workmen of the British Ráj repairing a Moslem tomb, and using for the purpose red sand-stone from the distant and far-famed quarries of Futtipúr Sikri.

In the gardens of the mausoleum I saw at dusk a number of Hawk-moths at the yellow tubular flowers of a small tree; probably a species of *Allamanda,* but possibly *Tecoma stans,* Juss. My short-handled net only allowed me to catch two, which proved to be beautiful specimens of *Nephele hespera,* and *Choerocampa celerio,* Linn.

In writing to Dr. Dixey from Lahore, I made the suggestive remark: "It is evident that being late in the autumn many of the butterflies are old and much worn. Curiously enough they are more often tattered and torn than actually rubbed." It is difficult to apportion rightly the breaking of the wings between the work of thorns and insectivorous foes. Certainly Indian butterflies fly into and through bushes in a way that is not seen at home.

To my mind the greatest glory, of the many glories of Lahore, is the seventeenth century Musjid of Wazir Khán, which is covered with Nakashi work, a mosaic of shaped pieces of glazed pottery, a sort of out-door marqueterie. The patterns, floral and geometrical, are excellent, and on a scale exactly suited to their positions, a thing not very often seen in architectural ornament; the colouring is a harmonious blending of blue and yellow with green and purple, constituting the most successful out-door decoration for a hot climate that I have come across; seen against a bright blue sky it is simply perfect. A less beautiful thing in the city is the sheep, with a tail as fat as a leg of mutton. The printed cottons, which in general effect so much resemble those of Northern Italy, are made in Lahore.

In this city we realized how little effect a century of our occupation has had upon the changeless East. We have introduced kerosene oil and aniline dyes—*voilà tout!*

In the Ajáib Ghar, or Wonder House of Lahore, *Anglicé* Museum, well known to readers of "Kim," is a small collection of insects. This was useful to me, but the destruction wrought by *Dermestes,* etc., both among the insects and the textile fabrics of the Industrial Collection, is most sad. I trust Mr. Kipling will see to it.

AMRITSAR, lat. 31° 40′ N., alt. *circa* 750 ft.

November 5th and 6th, 1903.

At the sacred city of the Sikhs my collecting was practically confined to two gardens close to the hotel. Here a large dull brown butterfly, with somewhat of the *Vanessa* habit, spread itself perfectly flat upon the surface of the earth and more especially of the damp mud of the little irrigation channels, lying so close to the surface as to be with difficulty discerned, so exactly did it resemble the tint of the mud. I secured three which proved to be *Euthalia garuda*, Moore, all females.

Papilio pammon was common; besides males I took one female of Wallace's Form I, which differs but slightly from the male and hence is now termed *pammon pammon*. Of *Precis almana* I took one, of the ubiquitous *Belenois mesentina* likewise one, a female, but I was somewhat surprised to net a female *Colias fieldii*, since the great plain of the Panjáb seemed an unlikely locality for the genus.

Yphthima nareda, Koll., also occurred in the hotel garden, but was scarcely common; it flew close to the ground.

What struck me most about the famous Golden Temple of the Sikhs, next to the general picturesqueness of its surroundings (and the filthiness of the water in its tank), was the tablet just within the great silver gates, erected by the British Ráj to the memory of that famous party of the 15th Sikhs who defended their post on the frontier until every man had been killed.

The famous carpet factory was at a standstill because the Moslem workmen were keeping the great Sikh festival!

DELHI, lat. 28° 30′ N., alt. *circa* 700 ft.

November 7th—12th, 1903.

When collecting in the fair Kudsia Gardens outside DELHI it was impossible not to be stirred by the historic associations of the ground. Between the northern walls of the city, the famous Ridge, and the mighty Jumna, scarcely more than a furlong from John Nicholson's grave, there stands, nearly hidden by trees and flowering shrubs, all that is left of the Summer Palace of the kings of Delhi. Its crumbling walls, where not covered by Bougainvilleas or other creepers, bear testimony by many a bullet-mark and round-shot hole how fire-swept the place was during the long sweltering days of 1857. Concrete blocks with suitable inscriptions mark the sites of the breaching batteries of the last stages of the siege—batteries

placed strangely near the walls when measured by the range of modern guns, for yon unrepaired breach in the Water Bastion is scarce two hundred yards from the most advanced battery!

Here in a beautiful garden, the very ideal of quiet and peace, where the numerous grey-striped Squirrels are quite tame, and the greenest of Parrots and the crested Hoopoes look as if war were unknown upon earth—here I watched many gorgeous *Papilio aristolochiae*, Fabr., fluttering upon the flowers, or sailing over the trees; at one moment they looked like black *crêpe* against the light, at another they displayed a circlet of brilliant rubies beneath. Once I had three of these beauties together in my net. With them were a few *P. demoleus* and *P. pammon*, the latter being females of Form II.

Danaida chrysippus was also common; one, a male, was unusually small. *Crastia core*, Cram., was common in shady places under mango trees, but was rarely seen at flowers. The pretty little black and salmon-coloured *Teracolus calais*, Cram., was abundant alike in the Kudsia Gardens and close to the hotel, flying near the ground, yet not so easy to catch. One of them was very small. Of *T. puellaris* I saw two only. The wet-season form of *Terias hecabe* was abundant, flying low and about bushes.

Of the brilliant yellow and orange *Ixias pyrene*, Linn., I took but one; the less gaudy Orange-tip, *I. marianne*, Cram., was rather common, but some of them were worn and none very easy to catch. Here I took my first *Delias eucharis*, Drury, a very worn female. The common Whites were *Huphina nerissa*, all males, and *Belenois mesentina*, which was abundant at flowers. The slender little *Nychitona xiphia*, Fabr., flitted weakly along close to the ground, reminding me irresistibly of *Leucophasia sinapis*, Linn., in spite of all structural differences. One of these ghostly creatures was taken flying over a tablet that marked the site of "Battery No. IV. Left attack; mortars." One wondered whether there were any butterflies in that place during the terrible summer of 1857.

Have the natives forgotten those days? We have not. At Meerut—where the old women in cocked hats *did nothing*, while the mutineers were busy murdering Christians in Delhi—we saw British troops going to church with rifles and ball cartridge! In May, 1857, the mutineers tried to catch our men in church, unarmed, but the hour of parade was altered, so that their crafty scheme was happily frustrated.

Three or four *Precis lemonias* appeared to be rather fond of shade; they settled upon the ground in preference to flowers, and then were

hard to see. Of the gorgeous *Hypolimnas bolina* I saw one of each sex; it needed an effort to believe that they were one species.

The Blues included *Catochyrsops cnejus; Tarucus theophrastus; Chilades varunana*, Moore; and *C. laius*, Cram., this last was common. The only Skipper taken was *Telicota augias*, Linn.

A little Geometer, *Semiothisa fidoniata*, Guen., like a *Macaria*, was common among herbage, and one specimen of *Tephrina disputaria*, Guen., was taken in like situation. The first-named also came to light, along with *Oligochroa akbarella*, Rag. Can M. Ragonot have intended a deliberate insult to the memory of the great Emperor when he named this lowly and insignificant little Phycid after him?

Other moths taken in the Kudsia Gardens were the tiny Noctuids *Metachrostis badia*, Swinhoe, and *Earias insulana*, Boisd., the latter being common among bushes near a back-water of the Jumna.

In the verandah of the hotel I took a fine *Sphinx orientalis*, Butl., the eastern form of *convolvuli*, Linn.; it had probably been attracted by the lights the night before.

LÁLKÓT. November 10th.

Eleven miles south of Delhi lies this glorious city of ruins, and there, under the shadow of the Kutab Minar, flying over the stones and amidst the thorny vegetation were many Whites and Orange-tips. The butterflies appeared especially to delight in flying about inside the thorniest bushes, or even flying through and through them, so that torn wings were almost the rule. Prominent in the countless crowd of *Belenois mesentina* so employed were *Ixias marianne* and *I. pyrene*; a female of the former was distinguished by the substitution of cream-colour for white in the ground-tint of the wings. The delicate-looking *Teracolus etrida*, lover of ruins, was in abundance, flying close to the ground.

The great mosque of the Kutab presents several points of architectural interest, but one thing especially impressed me. It was erected by Kutab-ud-din Aibak, after the capture of Delhi, in 1191 A.D. The Mohammedan soldier had to carry out his designs through the instrumentality of Hindu workmen, who were ignorant of the principle of the arch. Accordingly we see in place of voussoirs, or wedge-shaped stones fitting together and constituting the arch, successive horizontal layers of stone, each "sailing over" or projecting beyond the other, while two flat slabs at the top take the place of the keystone. [Fig. 4.]

This is not the place to descant upon the wonderful pillar of wrought iron nearly 24 feet long, and of an average diameter of 14 inches. A truly marvellous piece of forging for the fifth century A.D. And what a testimonial for the climate that the inscription is still quite sharp after being exposed to the weather for fourteen centuries!

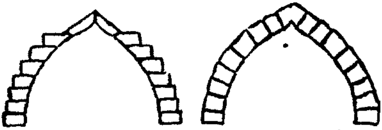


FIG. 4.

Delhi has been called the Rome of India, but whereas Romans speak of the Eternal City, Delhi has changed its site at least seven times in its history, and magnificent remains of some of its predecessors survive at Lálkót and Indrapat.

NÁINI TÁL, lat. 29° 30′ N., alt. 6500 ft.

November 16th—23rd, 1903.

Unlike Simla and Darjiling, which stand astride lofty ridges, NÁINI TÁL lies in a basin by a lake, a situation which, however pleasant it may be in summer, gives it in late autumn a dank feel. In summer it affords good collecting, I am told, but in November I found but few insects, and those mostly battered and forlorn-looking. The fauna, though more Oriental than at Simla, a degree and a half to the north, is much more Palaearctic than at Lahore, which is yet half a degree north of Simla, but of course upon the plain.

A very clear picture remains with me of a bright sunny afternoon, with a raw chill in the air very suggestive of home. On the one hand are Rhododendrons and Thujas growing as forest trees, and hard by cactus-like Euphorbias some 15 feet in height; on the other, Poplars are shedding their golden leaves in bright contrast to the crimson of the wild *Ampelopsis* (I cannot call it "Virginian" creeper); a Brimstone [1] butterfly dashes wildly past, then a belated Tortoise-shell [2] or Red Admiral [3] darts up from the path only to return again to the same stone, while several Small Coppers [4] disport themselves

[1] Probably *Gonepteryx nipalensis*, but possibly a *Catopsilia*.
[2] *Vanessa kashmirensis*.
[3] *Pyrameis indica*.
[4] *Chrysophanus pavana*.

about the autumn flowers on the bank. Quite a Palaearctic picture, surely.

In addition to the above I found at Náini *Terias hecabe;* the Hairstreak *Ilerda sena,* and the Blue *Zizera maha;* also the Fossor, *Pompilus analis,* Fabr., a female, while *Agrotis flammatra,* Guen., a British rarity, came to light.

A climb to the top of China Peak (pronounced Cheena), 8568 ft., produced two more Palaearctic forms, *Argynnis issaea,* and *Polyommatus baeticus.*

Five days were spent on horseback in an expedition into Kamáon as far as Ranikhet and Cháubattia, some twenty-four miles north of Náini as the crow flies. The road, at first so slippery with ice as to compel us to dismount, falls rapidly to Kháirna (Kháirana, or Khyrna, for the spelling seems uncertain). At about 6000 ft. *Ilerda sena* was again met with, at about 4000 ft. *Neptis astola,* Moore, and *Terias hecabe.* When near the bottom our eye was caught by the fluttering down of shells from a large pod-bearing tree. On glancing up we saw about a dozen charming-looking greenish Monkeys, their little black faces set off with most becoming white frills. It did not take them long to strip that tree of every pod.

At Kháirna, 3200 ft., a tiny village in a deep and narrow valley, I had a little further time for collecting, but it was limited by the steady march across the valley of the great chill mountain shadow, which sent all butterflies quickly off to bed. *Precis orithyia* was common, but the specimens were very small; *P. oenone, P. lemonias,* and *P. iphita* were also seen, the latter at flowers, not a usual habit of the species. Several *Athyma perius* were seen, also several *Catopsilia pyranthe;* of those taken one was of the *gnoma,* the other of the *pyranthe* form. Of *Ganoris canidia* and *Tarucus telicanus* I took one each, but *Zizera maha* was in abundance. In addition to these were *Utetheisa pulchella,* flying for short distances about low herbage according to its wont, also a Fly which hovered at flowers just like a Sphinx—a *Bombylius* not in the National Collection. The widely-distributed Grasshopper, *Thisoicetrus littoralis,* Ramb., which was very common, had the curious habit after its short flight of settling so brusquely upon a shrub as to make its branches shake, but then quickly making its way to the ground. I missed a *Macroglossa* twice at the same flowering bush. Late in the afternoon I took a *Papilio pammon* (a female of Wallace's Form II., *polytes*), which was flying about and into bushes, apparently seeking for a resting-place for the night, but possibly for a plant whereon to lay its eggs.

Close to the village of Kháirna I saw upon the cliffs by the

roadside several beautiful Lizards, grey-spotted, with bright blue legs.

During the long and hot pull up again from Kháirna to the ridge on which stand Ranikhet and Cháubattia, a dwarf *Precis orithyia* and a *Neptis astola* were taken at about 3500 ft., and at about 4000 ft. *Belenois mesentina*, *Pyrameis indica*, and *Ilerda sena*.

At Ranikhet, 6000 ft. (where, by the way, the cooking at the Dák bungalow was the best that we came across in India), Monkeys were not uncommon in the woods, but unlike our legumen-loving friends of Kháirna, of a revoltingly ugly type; Butterflies, however, were scarce, and were represented by *Pyrameis cardui*, *Vanessa kashmirensis*, *Ilerda sena*, and *Lycaena maha*, var. *diluta*.

At Cháubattia, four miles to the east of Ranikhet, and at a height of about 6200 ft., the officers' quarters command a most glorious panorama of Nanda Devi, 25,749 ft., Nanda Kót, 22,491 ft., and Trisúl, 23,581 ft., mountains of unsurpassed grandeur of form, and held most sacred by pious Hindus as sources of Holy Ganges. These stand between fifty and sixty miles away, yet shine forth as clear and bright as if quite close. As we gazed in rapt admiration at these giants among giants, we little thought that within four years my nephew, Dr. Tom G. Longstaff, would earn a world-wide fame by struggling to the top of Trisúl, not indeed the highest but quite the most striking of the three.

On the road to Cháubattia we met with rather more butterflies, viz. our old friends *Terias hecabe*, *Precis oenone* and *P. lemonias*, *Pyrameis cardui*, and *Chrysophanus pavana*, and in addition something quite fresh, the Erycinid *Dodona durga*, Koll., of which I got three specimens; though a small insect it proved tenacious of life. A little beetle, *Oides* sp., was taken flying over the road.

On descending again from Náini to the plains I found, as at Simla, that butterflies got more numerous and more Oriental in character. At the top of the road the Hairstreak, *Ilerda sena*, was common; at 5000 ft. *Ypthima philomela*, Johanss., was met with; at the Brewery, *circa* 4500 ft., butterflies were very common at a flowery turn of the road, and I took *Pyrameis indica*, several *Precis iphita*, *P. lemonias*, and a male *Hypolimnas bolina*, while I missed a brown and white *Neptis*-like butterfly which may have been *Rahinda hordonia*, Stoll, or, possibly, *Symbrenthia lucina*, Cram.

LUCKNOW, lat. 27° N., alt. *circa* 500 ft.

November 24th and 25th, 1903.

LUCKNOW possesses a museum containing a fair collection of insects, which would have been more instructive if the majority of the species had been named.

In the beautiful garden of the Dilkusha Palace, where Havelock fell sick of the illness that was to prove fatal in the very hour of triumph, there was a great wealth of flowers and consequently a great assemblage of butterflies. Besides such things as *Papilio demoleus; Argynnis hyperbius,* a female; *Hypolimnas misippus,* several males; *Crastia core,* both typical and the variety *vermiculata,* Butl.; and a *Catopsilia* which evaded capture, I took there my first *Rapala melampus,* Cram. This is a small copper-coloured butterfly belonging to a genus which, with its robust body, sharp-cut wings, and curious anal lobe to the hind-wing, looks very different from our Hairstreaks or Coppers. It is neither easy to see on the small flowers which it frequents, nor to catch.

Other butterflies taken in the same garden were the Blues, *Catochrysops strabo,* Fabr., *Tarucus telicanus,* and *Zizera* (?) *argia,* Moore, var. *similis,* the last two in abundance; *Mycalesis perseus,* Fabr., and the brilliant tawny Skipper, *Telicota augias.* A beautiful little Noctua with yellow under-wings, *Hyblaea puera,* Cram., was taken at flowers in full sunlight. I also took a Grasshopper, *Gastrimargus marmoratus,* Thunb., a species of wide distribution.

By the roadside between Dilkusha and La Martinière a few *Chilades putli,* Koll., a tiny brown Lycaenid, were obtained.

At tbe Alam Bagh, ever to be remembered in connection with Colin Campbell, the dry-season form of *Terias hecabe* was flitting quietly about, and I netted *Ixias marianne* (not so vulgar-looking as its name might lead one to expect), also a variety of the female of *I. pyrene* without the orange-tip. A male of the wet-season form of *Huphina nerissa* was also taken, while *Delias eucharis* was common —one was feeding on *Zinnia* flowers close to Havelock's grave. *Utetheisa pulchella* was flying commonly in the sun amongst the grass, and with it a specimen of its near ally *Argina cribraria,* Clerck. The Coleoptera were represented by *Mylabris sidae,* and the Micros by a Pyrale, *Pyrausta phoenicealis,* Hübn. (*juncturalis,* Walk.).

Peel's naval guns at the Residency reminded us that the sailor-men were as handy in the relief of Lucknow as in the defence of Ladysmith. But there were no butterflies to be seen in the well-kept garden on the afternoon of our visit, and perhaps that was as well

since our minds were filled with deeper thoughts. I stood bareheaded in the little cemetery beside the plain slab of stone that bears the majestic inscription, dictated by the hero himself:

HERE LIES

HENRY LAWRENCE

WHO TRIED TO DO HIS DUTY

* * * * *

When the mutiny broke out, our obliging guide, then a boy of eighteen, was in the great Martinière school. He sang in the choir of the Residency Church, and one Sunday afternoon as they were practising the *Magnificat* some one burst in crying out that martial law had been proclaimed, and that they were to get back to their school with all haste. What did they do, think you? *They finished the Magnificat!* . . . You may imagine the quiet pride with which the now elderly man, who as a big boy had carried a musket throughout the defence, told us that he still sang in that choir.

BENARES, lat. 25° N., alt. 270 ft.

November 28th–December 2nd, 1903.

The sacred city of the Hindus, as a city, was a great disappointment: the temples are all small, mostly mean, and those that are not filthy are at any rate dirty. But the view of the Ghâts from the Ganges is the most interesting in India. The buildings of the Ghâts themselves, modern as they are, rival some of the works of ancient Egypt, while the groups of the bathers in the holy river form a constantly moving picture. Many of the worshippers at their morning prayers seemed truly devout, yet as a whole they did not impress one as Moslems do.

BENARES proved more remarkable for the number and variety of its pilgrims than for its Butterflies. In the hotel gardens, where Jackals howled loudly by night, a few battered specimens of *Papilio demoleus* were seen by day, and the males of both species of *Hypolimnas* were fairly common. Of *H. bolina* I took a fine female, while of *misippus* I also sent home a female marked "common." It is, however, certain that at the time I did not know this insect to be a *Hypolimnas*, since I only learned from the Calcutta Museum Collection that the female of *misippus* was brown. There is therefore little doubt that it passed for a variety of *Danaida chrysippus* which it mimics in such a surprising manner, and which certainly was common enough in the

same garden. It is one of the inconveniences of the method of "enveloping" one's captures that so much is left to memory, and the chances of comparing insects are so very few. Dwarfed specimens of *Precis orithyia* were now very common; *P. oenone* and *P. lemonias* were less common but almost as small; several *P. almana* occurred. But in spite of the excessive drought and the consequent occurrence of dwarfs,[1] one of my specimens of *Terias hecabe*, taken at Benares, was quite of wet-season type. *Catopsilia pomona* was represented by a very large male of the typical form and a smaller female in fine condition, exhibiting the transition to the *catilla*, Cram., or extreme dry-season form. Similarly, *C. pyranthe* was represented by a male of the typical and a female of the *gnoma* form.

Together with the above were several smaller things: among the Blues *Polyommatus baeticus* occurred, while *Catochrysops strabo,* and the tiny *Chilades putli*, were both common. The Skipper *Parnara mathias* was also common, and I took one *Telicota augias.* The little Pyrale, *Zinckenia fascialis,* was in some numbers in one small flower-bed. Of the long-waisted Wasp, *Eumenes esuriens,* Fabr., I saw but one, a female.

But among the frequenters of the small garden adjoining the hotel those that interested me most were the "lobed" and "tailed" Lycaenids, of which there were no less than four species. Of *Aphnaeus ictis*, Hew., I took a solitary male; of *A. elima,* Moore (which, however, de Nicéville considered to be only a dry-season form of *ictis*), I secured two, also males. Of the third species, *Pratapa deva*, Moore, but one turned up, and that had lost the anal angles, with their appendages, and a large part of both hind-wings, which had apparently been bitten off, absolutely symmetrically, by a lizard. The fourth species, *Rapala melampus,* was common, and I secured seven specimens, all, however, males.

Concerning *R. melampus* I wrote to Dr. Dixey at the time: "The Tailed Copper (or Hairstreak), first seen at Dilkusha, Lucknow, and found commonly here [Benares] to-day, greatly interests me. Not only is it very beautiful, but it is surprisingly hard to see, especially when at rest. Then the structure of the hind-wing is most strange; posterior to the tail (the next interspace but one) a portion of the

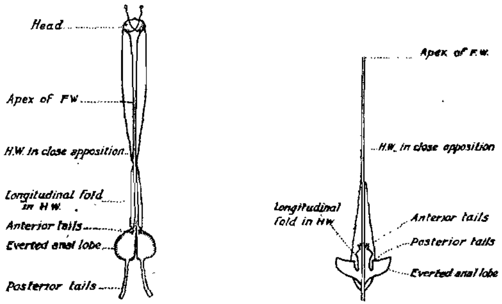
[1] This appears to contradict Prof. Poulton's observation that the dry-season form of the seasonally dimorphic *Precis sesamus*, Trim., is in S. Africa *larger* than the wet-season form. But the *sesamus* that he weighed had passed the larva and pupa stages during the wet season, whereas my small Indian *Precis* were of the *second* dry-season brood at least, so that their larvae and pupae had been submitted to dry-season conditions.

wing, nearly circular, with a very obvious fringe of large scales, is set at right angles to the plane of the wing and to the direction of the veins." [See Fig. 5.]

According to Schatz and Röber,[1] this "anal lobe" occupies the space between the sub-median and inner marginal veins; the second anal and third anal of Comstock; 1*b* and 1*c* of Meyrick; but I have not found in these authors any allusion to the striking fact that this lobe is quite out of the plane of the wing. This omission may be due to the fact that the process of setting usually flattens the lobe out

APHNAEUS ELIMA, Moore.

Enlarged from sketches from the living butterfly.



Diagrammatic view from *above*. Diagrammatic view from *behind*.

Drawn at Benares, November 30, 1903, *by* G. B. LONGSTAFF.

FIG. 5.

so that its natural form is hardly seen in cabinet specimens. It did not occur to me at the time (and the suggestion arrived by letter too late) that the object of this structure is possibly to produce the appearance of a head in a non-vital part, the tails representing the antennae. However, drawings made at the time strongly bear out the suggestion. The resemblance would be still more striking if these Lycaenids, like so many of the family, habitually rest with the head downwards.[2]

In another letter from Benares I said: "Thorns are not specially bad here, only that one does not know the look of many thorny

[1] *Exotische Schmetterlinge*: II. Theil. *Familien und Gattungen der Tagfalter*, 1892, pp. 268–9, Plate 47.

[2] See Chapter X., § 10.

plants until too late. But, on the other hand, burrs of every sort and kind abound to an incredible degree and tangle up the net; much of one's time is spent in freeing net and breeches therefrom."

It might have been added that at Benares I first made acquaintance (somewhat intimate) with "Spear-grass," which is yet more provocative of bad language than either thorn or burr. Indeed, I am disposed to conjecture that Spear-grass, and not the Darnel or Rye-grass of commentators, was the "Tares" which the devil sowed amongst the wheat.

Some three miles from Benares, on the way back from Sarnáth, where Buddha first taught, *Delias eucharis* was flying in extreme abundance in a small field of the tall Marigold which is so much cultivated for the service of the temples. A truly gaudy sight it was to see crowds of these white, yellow, and scarlet butterflies upon the orange-coloured blossoms.

CALCUTTA, lat. 22° 30′ N. Near sea-level.

December 4th–12th, 1903.

Naturally one could not expect to turn up anything new at Calcutta, the capital of India, and long the home of de Nicéville, that martyr to science who met his death in the deadly Terai when officially investigating the life-history of an insect pest. However, I determined in the few days at my disposal to get at any rate a sample of the fauna of Lower Bengal.

The Eden Gardens, abutting on the Máidán and close to Government House, bear much the same relation to Calcutta as Kensington Gardens to London, and from their proximity to the hotel afforded a convenient collecting ground for odd hours.

The *Duranta* was nearly over, and the most attractive feature proved to be a hedge of *Lantana* in full bloom. These dissimilar plants both belong to the *Verbenaceae* and are both natives of the West Indies, although the latter appears to have run wild in many parts of the East. On that hedge *Danaida chrysippus* was in abundance, accompanied by *D. plexippus* (*genutia*), which I had not seen since I was at Malakand, while numerous *Tirumala limniace* and *Crastia core* completed the company of the Danaines. I was able to confirm my Benares observation that the male of *D. chrysippus* had a slight but decided odour suggestive of cockroaches, which was perhaps stronger when the "scent sacs" on the hind-wings were opened, though of this I was not sure. On the other hand, the male

of *C. core* had a faint scent that suggested to me rancid oil, or old lamps. So far as I could judge, this scent was connected with the hind-wings, but *not* with the very conspicuous genital tufts.

At the *Lantana* flowers along with the Danaines were abundance of *Suastus gremius*, Fabr., a somewhat dingy Skipper, also a few of the brilliant and conspicuous *Delias eucharis*. The upper-side of the female of this species faintly mimics *Tirumala*; the male yielded, on rubbing the wings, a sweet flowery scent, which I was not at first able to describe, but later it struck me as resembling that of our domesticated *Ganoris rapae* and suggestive of sweet-briar. Dr. Dixey informs me that scent-scales are very numerous in *Delias*.

In the shadier parts of the garden together with numerous *Terias hecabe*, one at least of markedly wet-season type, and many *Yphthima hübneri*, Kirby, several *Nychitona xiphia* were found, which, as ever, reminded me of *Leucophasia sinapis*, a slender form and fragile appearance being in each species associated with a weak flight close to the ground. One of the *Y. hübneri* had the whole hind margin of both hind-wings bitten off nearly symmetrically.

Catopsilia pyranthe and *C. pomona* were both met with, the former the more frequently. No *Papilio* turned up although I was told that *P. pammon* occurs in the garden. Amongst young Palms the males of *Elymnias undularis*, Drury, were occasionally disturbed, and a very striking thing it is. Then *Nepheronia hippia*, Fabr., came along, flying strongly, the male looking on the wing, or more especially when settled on a flower with wings expanded, much bluer than its cabinet appearance might lead one to suppose. Three *Limenitis procris*, Cram., proved difficult to catch, preferring the leaves of tall shrubs to flowers; but it is scarcely as graceful on the wing as our White Admiral.

I took two specimens of *Catochrysops pandava*, Horsf., var. *bengalia*, de Nicév. (being the dry-season form); the female is a demure creature, but the male is of an iridescent blue, bordered with black. *Hypolimnas misippus*, a male, *Precis almana* and *P. lemonias* completed the list of twenty species taken in four visits to the gardens. With them was a Fossor, *Elis thoracica*, Fabr., a female.

The walk from the hotel to the museum went far towards solving the problem of the disproportion between the garrison of Calcutta and the size of the city. The pavement of the road alongside of the Máidan (the first green one that we had seen in India) is of quite unusual breadth. It is usually occupied by throngs of people, mostly Bengális. Presently three Patháns sipáhis come swaggering along the middle of the path arm-in-arm. Instantly the crowd

divide and leave the pavement bare. It is evident enough that the respective feelings of Bengáli and Patháп are those of fear and contempt.

BÁLIGANJ.

At the truly splendid museum (where, by the way, I saw a native artist at work producing some of the very best coloured figures of beetles and butterflies that I have seen), Mr. S. E. Peal, besides helping me in other ways, put me on the track of one of the late Mr. de Nicéville's favourite collecting-grounds, a *rus in urbe*, at BÁLIGANJ, a suburb only three miles from the hotel. I visited this place twice, on December 5th and 9th. It consists of a large deserted garden long run wild; weedy meadows and jungly woods are all that is left of once trim lawns and ordered shrubberies, while a palm avenue and several tanks covered with a floating flower of the Convolvulus order, harbouring countless dragon-flies, complete the tale of departed greatness. Altogether it is full of sad beauty. Palms and Crotons with an undergrowth of ferns were the characteristic plants, flowers were few, yet in certain favoured spots butterflies were in quite bewildering swarms. The quiet charm of this old garden was greatly enhanced by the absence of curious natives and the (comparative) absence of burrs, that curse of "up-country" collecting, though certainly the unsuspected prickles of innocent-looking Palms to some extent took their place.

Some of the species seen near the centre of the city, in the Eden Gardens, were here conspicuous by their absence, e.g. *Limenitis procris*, *Precis lemonias* and *Hypolimnas misippus*.

The four common Danaines, *Tirumala limniace*, *Crastia core*, *Danaida plexippus* and *D. chrysippus*, were not so common as might have been expected, probably owing to the scarcity of the flowers they love. In the last-named species I was able once more to confirm the presence of a distinct, but not strong, odour suggestive of cockroaches. A few *Papilio pammon* of both sexes gave to the assemblage that air of distinction which the genus always has. Among the more sombre things, most frequent under the shade of groves, were a number of *Mycalesis indistans*, Moore, together with one *M. perseus*, which two species, so far as observed, have no "list" when at rest. In the shade also were two or three *Melanitis ismene*, Cram. Close down among the herbage together with *Ypthima hübneri* there were flying large numbers of *Y. philomela*, Johanss., (*baldus*, Fabr.) certainly a gregarious species.

Precis almana was noted, and *P. atlites*, Johanss., here came under my observation for the first time, but in poor condition; it is then a rather ghostly-looking butterfly though a somewhat strong flier; this last is also true of *Atella phalantha*. A single specimen of my old Amritsar friend *Euthalia garuda* was observed, as before, to settle with its wings fully expanded and closely appressed to the the ground. *Elymnias undularis* was in abundance; it is especially addicted to the characteristically Indian butterfly habit of flying into or through bushes, and even of flying about *inside* them. It is clearly gregarious, several specimens flying in and about one bushy Palm, its food-plant. The male is very striking on the wing, and when settled, even though the under-side is somewhat leaf-like, it is yet quite conspicuous. The female, on the other hand, is on the wing a very fair mimic of *Danaida plexippus*, but its flight is weaker.

Catopsilia pyranthe and *C. pomona* were both rather common; *Terias hecabe* was abundant, and, as usual, gregarious, or, at least, sociable.

In half-shaded spots an occasional *Nychitona xiphia* flitted slowly along close to the ground. *Ergolis ariadne*, Linn., was abundant; of *E. merione*, Cram., two specimens were secured. The butterflies of this genus settle with the wings three-fourths expanded.

Nepheronia hippia was rather common; though its female somewhat mimics *Tirumala limniace*, the male, when on the wing, looks much bluer than that insect.

A brilliant fulvous Skipper, *Telicota bambusae*, Moore, was the only representative of the group, but there were several Blues, to wit: *Catochrysops strabo*, which was common; *Lampides celeno*, Cram., larger than usual, one being of the form *alexis*, Stoll; and a lot of *Neopithecops zalmora*, Butl. A single example of *Curetis thetis*, Drury, apparently bitten by some enemy, fell to my net; its silvery-white under-side is very striking. But perhaps the strangest-looking butterfly of the lot was *Loxura atymnus*, Cram., of which I got two. Its wings are much plaited longitudinally, and when at rest its extremely long tails, crumpled look, and brown colour give it quite the appearance of a dead leaf. A closer examination shows that the portion of the hind-wing near the anal angle is bent down, or back, nearly to a right angle; this bent portion is, however, relatively smaller, more oval and less sharply bent than the rounder anal lobes of *Rapala* and *Aphnaeus*; moreover it is not furnished with the very large marginal scales which are so conspicuous in those genera.

TOLIGANJ. *December 7th, 1903.*

About two miles from Báliganj, and due south of Calcutta (about half a mile beyond the Sports Club), is the locality referred to as TOLIGANJ. Here, too, is an old abandoned garden, but lacking the elements of departed grandeur that give a poetic colouring to de Nicéville's old hunting-ground. The prominent features are a great profusion of *Lantana* in full bloom, a Bamboo grove and a good deal of thorny jungle. The day that I was there the *Lantana* was the chosen haunt of great numbers of the bigger butterflies such as *Delias eucharis, Tirumala limniace, Danaida plexippus, Papilio pammon,* mostly worn, *P. aristolochiae*, and a few *P. demoleus*, together with an occasional *Nepheronia hippia,* with his broad wings proudly expanded to view. The sight of these big fellows, expanding from three to four inches, quietly settled on the flowers, or fluttering after the manner of *Papilio*, or grandly sailing around—gorgeous in their white, yellow and scarlet, black and grey blue, mahogany-brown and black, black and cream colour, black and coral-red, black and yellow, or sky-blue and black—afforded indeed a glorious sight not soon to be forgotten. Alas! such a tropical glory takes much colour out of the most vivid mental pictures of butterfly life at home.

In a shady grove not far from these flowers *Danaida plexippus* was simply swarming, as many as ten or even twenty being in sight at once, for it is one of the most gregarious butterflies that I have met with. A few observations on this species and *Tirumala limniace* failed to detect any odour, but it was far otherwise with *Delias eucharis*, of which several specimens had a distinct sweet scent, very like that of *G. rapae*. My strong impression is that this scent is confined to the male, but I cannot, unfortunately, speak with certainty on the point. The male of *Huphina nerissa* has a distinct scent, also like that of *G. rapae*, although the butterfly itself more resembles *G. napi*. The scent of these two butterflies is neither so strong nor so unmistakably characteristic as that of *G. napi*, but its existence is quite beyond question.

These scents are not easy to deal with. The human nasal organ is but a poor affair at best, moreover scents are very hard to describe, and these butterfly odours are only suggestive of, certainly not identical with, those to which I have, for want of any better standard, compared them. Then the scents are transient and may easily be scattered by the wind or overpowered by neighbouring flowers. Again the scales, independently of any scent, are irritating to the mucous

membrane, and any one who has tried to use the sense of smell for diagnostic purposes must know how even the most volatile perfume is apt to linger on, lurking as it would appear in the cavernous recesses of the nose. Of course it is much easier to determine in the field whether or no a scent is sexual in the case of those species in which the sexes are distinguishable by very obvious characters. Lastly, it should never be forgotten that in all probability the scents described are far more obvious to the insects themselves than to human observers.[1]

Only a solitary representative of the *Euploea* group appears among the Toliganj specimens, but its envelope bears the note: "Common, has a slight peculiar scent, rather disagreeable." Most probably I believed this at the time to be the common Calcutta species *Crastia core*, but it turns out to be *Pademma kollari*, Feld., and it is now impossible to say what those were that I passed over or missed.

In variety the Toliganj butterflies were disappointing, but, besides the above named, they included a very fine female *Ixias pyrene*, the sole Orange-tip seen at Calcutta; a few *Catopsilia pyranthe;* several *Ergolis ariadne; Elymnias undularis*, not common; plenty of that very distinct Blue, *Neopithecops zalmora;* a single specimen of *Loxura atymnus*, and plenty of *Yphthima hübneri, Y. marshalli, Y. philomela* and *Nychitona xiphia*.

The list is closed by "*Melanitis ismene*, lover of darkness, as its name seems to say. It flitted about everywhere dressed in all the tints of fallen leaves, or, alighting among them, fell partly on one side and was one of them."[2] I quote the words of E. H. A(itkin), that keen observer and telling writer. The few specimens that I saw that day were very dark and of the dry-season form. A note made at the time says: "This shade-loving species, which only flies for a *very* short distance and settles on the ground, has a 'list' to the right of 20–30°, making it very like a dead leaf."

A pretty blue and black parasitic bee, *Crocisa histrio*, Fabr., was caught feeding on the wing like a Sphinx.

On December 8th, I visited the grand Botanic Gardens at Howrah, but it was too late in the day for many butterflies to be about. Very late in the afternoon, just before leaving the gardens, I noticed a few *Danaida plexippus* (*genutia*) fluttering about a Palm-tree prior to settling down for the night. On looking carefully I saw on one of the huge leaf-stalks, some twelve or fourteen feet from the ground, a *cluster* of the butterflies *hanging together like swarming bees*. By pelting with sticks and stones the cluster was broken up and proved

[1] See Chapter X., § 1. [2] *A Naturalist on the Prowl*, p. 208.

to consist of at least seven or eight individuals. Altogether there were perhaps twenty in and about that tree. This certainly establishes the fact that *D. plexippus* is gregarious. Both Mr. S. E. Peal and Mr. F. Möller told me that they had never seen such a thing. However, some years afterwards I came across a letter from Prof. Vernon L. Kellog to Prof. E. B. Poulton, in which he says:—

"The Monarch Butterfly, *Anosia plexippus*, gathers each winter in thousands in a small forest of Pine trees on Point Pinos peninsula on the bay of Monterey. Sometimes these butterflies will gather in a single tree in great clusters and festoons; other winters they will not be so completely massed, but will be spread over a few acres of forest . . . our winter here is very mild; there are bright warm days all through it, and these butterflies do not by any means remain immovable during their hibernation."[1] The butterfly here alluded to is the American *Danaida archippus*, Fabr. (*plexippus*, Linn.), and is very closely allied to *D. plexippus*, Linn. (*genutia*, Cram.) There is no doubt an error in the original record of locality, since Linnaeus' description of *plexippus* applies to the Oriental insect.

Just outside the garden gates is a populous village through which the road to Calcutta passes. A Calcutta merchant driving a friend home from the gardens one Sunday at night-fall found the bazár as usual crowded with men, women and children, all over the roadway. As ill luck would have it he knocked down and ran over a native. At the time Lord Curzon had been preaching a crusade against ill treatment of natives, and horrible thoughts passed through the driver's mind of leading articles in the native Press. He stopped of course and got out to find a woman who was evidently dead! All his fears were redoubled when a man ran up and said, "Only old woman, Sáhib; my mother, Sáhib." The merchant began to pour out his regrets and his willingness to do anything in his power, when to his surprise the native said he would be quite satisfied with the payment of fifty rupees (about three guineas). His relief was immense, for he would gladly have paid ten times as much to get out of his difficulty, so he said that he was willing to give him that sum but that he had not so much money about him; however, if the man would call at . . . (a well-known commercial address) at nine o'clock the next morning he would be paid. Accordingly he drove back to Calcutta with a load off his mind. On Monday morning, after he had been sitting in his counting-house for some hours, a clerk came in and said: "By the way, sir, there is a native here who

[1] *Proc. Ent. Soc. Lond.*, 1904, p. xxiii.

has been waiting to see you since 6 o'clock." "What on earth does he want?" "I don't know, sir, but he says he wants to see you himself." "Very well, show him up." Thereupon a native entered, made a low salaam, and presented a "chit" (account):—

> *Ram Lal*
>
> *To one mother*, Rs. 50

DARJILING, 27° N., alt. 7000 ft.

December 13th—22nd, 1903.

I set off to this celebrated hunting-ground with great misgivings as to season, but still full of wild hopes. The ascent by the cog-wheel railway took us through a most interesting forest, where amongst other things we saw our first Tree-fern, as well as the far more beautiful wild Banana (*Musa* sp.). Near TINDARIA, at about 3000 ft., I saw several *Ixias pyrene* and succeeded in catching one from the train while it was going at full speed—about seven miles an hour! This was a male of the large form *evippe*, Drury.

Before reaching KURSEONG, nearly 5000 ft., where I had arranged to stop with a view to a little collecting, we got into the clouds, and at our destination it was very cold, with an atmosphere only too like that of the West of Scotland. During a gleam of sunshine I took a *Vanessa kashmirensis*, a poor dull thing compared to our *urticae*. At night two moths, an Acidaliid *Erythrolophus* (*Synegiodes*) *hyriarius*, Walk., and *Caradrina albosignata*, Oberth. (thought by Sir G. Hampson to be probably identical with *lineosa*, Moore), came to light.

The following morning was brighter and we started early to walk up to the next station, TOONG, but though the weather was more benignant, the railway ran through a district devoted to tea-growing which did not promise well for collecting. A few *Vanessa kashmirensis*, a *Pyrameis indica* and a *P. cardui* flew along the road, the latter with both apices of the fore-wings and one hind-wing near the anal angle apparently bitten. Near Toong station, 5500 ft., in a sheltered and flowery spot I took single specimens of the Hairstreaks *Ilerda epicles*, Godart, a female, and *Camena cleobis*, Godart; the latter on the upper surface is like *Thecla quercus*, but bluer, on the

underside almost white with a practically black spot on the anal lobe. Here also I took a male *Hiposcritia lalage*, Doubl., and a native caught in his fingers a *Dodona eugenes*, Bates, an Erycinid, and the same man brought me a fine Saturniid moth *Loepa newarra*, Moore, 6½ inches in expanse, apparently not long dead.

Meanwhile all trace of cloud had disappeared and when the train rounded the last corner our eyes met a sight to take one's breath away. There in grand array stood seven snowy peaks—each over 20,000 ft. in height—and overtopping all the mighty three-peaked Kangchinjanga himself, full four miles above us and seeming to look straight down upon us from the sky, though in reality some 45 miles away. And this was not all, for we could see down into the blue valley at least a mile below the train. A vertical range of 5 miles! We had the great and unwonted good fortune to see both the after-glow of sunset and the fore-glow of sunrise on those majestic snowy heights every day of our stay. There was, however, one phase as strange as it was beautiful, when the horizon appeared to be bounded by a range of lesser mountains, distant perhaps 30 miles, beyond which there seemed to be unbroken blue sky. Where was Kangchinjanga? Raising the eyes a little its triple peak was seen, floating as it were in mid air, like the Island of Laputa! The explanation I take to be that 20 or 30 miles of atmosphere is enough to make "blue sky," just as sometimes on an apparently clear day the cliffs of Cap Gris-Nez are not visible from Dover. From the top of Tiger Hill one morning we saw the conical top of Everest, 120 miles off, peeping over the intermediate ranges from his commanding height of 29,002 ft. (Note the accuracy of the trigonometrical survey of India.) Unfortunately we were prevented from going to Phallút, and so making a somewhat less distant acquaintance with Everest, because the rest-houses were all in the possession of Government agents buying yáks for the Tibetan mission.

Entomologically speaking, our visit to Darjiling was the saddest of disappointments, for it was as cold as England in November, and the local entomologists—Messrs. Möller and Lingren—assured me that *Kallima* was hopelessly over, as indeed were most things. They, and every one we met, spoke of the astonishing multitudes of butterflies in the rainy season; the harder it rained, they said, the more insects there were in the short interludes between the showers.

On the high ground I got little; *Vanessa kashmirensis*, *Pyrameis indica* and *cardui*, none of them common, also a brilliantly-coloured beetle, a species of *Cassida*. I saw a school-boy catch *Colias fieldii*

and a tailed Blue. At JALAPAHAR, 7500 ft., I got a female *Huphina nadina*, Luc. (*remba*, Moore).

The only chance was to go down into the valleys, but it takes long to descend, and as the butterflies are for the most part only "at home" from 10 a.m. to 2 p.m., one does not get many hours' collecting; moreover, from those precious hours there are deductions to be made for sunless intervals due to clouds, the shadows of woods, and the still deeper shadows of lofty mountains.

My first expedition, lasting three days on horseback, was to the Tísta valley, lying to the east of Darjiling. On December 17th, we went to PASHÓK, about 17 miles, sleeping at the Public Works Department rest-house, about 2300 ft. above the river, and about 3000 ft. above the sea, a delightfully situated lonely bungalow in the woods, where the air was filled with the chirrupping of cicadas, a sound that hugely delighted my daughter's ayah.

When we got down to about 4000 ft. above sea-level insects began to be fairly numerous, although it was late in the day for butterflies. *Vanessa kashmirensis* was common, and with them were several *Pyrameis indica*. I secured two of the handsome White *Hiposcritia lalage* (*argyridana*, Butl.), both females. Several *Neptis astola* were seen, mostly worn. At a shady turn of the road I got *Lethe rohria*, Fabr., an *aegeria*-like Satyrid butterfly; close by *Arrhopala areste*, Hew., flashed azure in the sunlight, but a specimen of another beautiful Lycaenid, *Spindasis vulcanus*, Fabr., was badly battered. Of *Zemeros flegyas*, Cram., and *Abisara fylla*, Doubl., I netted one each, and a large bee, *Bombus* (?) *funerarius*, Smith, a male, tempted me to catch him.

In the wood in which the rest-house stands *Mycalesis indistans* was in abundance; this is a typical shade-lover; when kicked up from the herbage it flaps about three yards like our *Epinephele janira*, and then settles on dead leaves or on the earth. Some of them had a slight "list," but this did not seem to be a marked habit, possibly because this position is not so advantageous in shade as in sunlight, though the habit was first noticed in *Melanitis*, a typical shade-loving genus. The existence of shade-loving butterflies might seem to be correlated to a tropical sun, but even in England *Pararge aegeria* and *Epinephele hyperanthus*, still more *Leucophasia sinapis*, are what I should term partial shade-lovers.

In the same wood, also in the shade, *Terias laeta* and *T. hecabe* were both plentiful, and in sunnier glades the common Indian Blue, *Lampides celeno*, was both abundant and gregarious. In a young Cinchona plantation close by I found *Gamoris canidia*: a Blue

Cyaniris puspa, Horsf.; and a very large handsome Skipper, *Celaenorrhinus leucocera*, Koll. In the rest-house there was a dead Pyrale, *Lepyrodes geometralis*, Guen.

The next day, December 18th, I sent my pony on ahead, and walked down to the river collecting on the way. In the Cinchona plantation close to the rest-house I found *Zemeros flegyas;* lower down were *Euthalia appiades*, Ménét., of which I saw several worn specimens; a Hairstreak, *Arrhopala bazalus*, Hew., like a glorified *Thecla quercus; Lethe verma*, Koll.; and *Melanitis ismene*, the last as usual in the shade.

A path leading off through the wood brought me to a tea-garden, perhaps 1500 ft. above sea-level, where I lingered all too long. Tea-gardens are not as a rule good places for butterflies, and the pretty flower of the Tea-plant, then just coming out, does not appear to have great attractions for them, but this particular garden, just at the edge of the forest, and especially that corner of it where a little stream runs in, was certainly very prolific.

Athyma ranga, Moore, was in abundance, though worn; likewise its relatives of the genus *Neptis*, but the three specimens that I sent home belonged to as many so-called species: *N. aceris*, Cram., *N. astola*, and *N. varmona*, Moore; the closely allied, but brown and black, *Symbrenthia lucina*, Cram. (*hippoclus*, de Nicév.), was almost as common among the Tea-bushes. Of the satin-winged *Hiposcritia indra*, Moore, I took two females. Of the following I got single examples only:—*Caduga melaneus*, Cram., and *Parantica melanoides*, Moore, two very similar black and white Danaines; *Athyma selenophora*, Koll.; *Yphthima philomela; Arrhopala centaurus*, Fabr.; and *Castalius anaura*, de Nicév., a female, while another Blue, *Lampides elpis*, Godart, pale and beautifully sheeny, was common. I also missed what was, I believe, *Libythea rama*, Moore. There were in addition two moths, an Arctiid, *Leucoma submarginata*, Walk., and a Hypsid, the fuscous and white *Zonosoma cenis*, Cram. (*interlectum*, Walk.), the former possibly, the latter certainly, a day-flyer. The great number of fresh species showed that I had entered a distinct geographical sub-region.

At last I dragged myself away and an hour later reached a most attractive flowery bank immediately above the river. This was evidently a great place, for in a very short time I secured two sadly battered *Papilio memnon*, Linn., of the form *agenor*, Linn.; a large male *Ixias pyrene* with the fore-wings almost symmetrically bitten near the tip of the costa; also an insect that I had greatly desired to take, the lovely and delicate-looking Map-butterfly, *Cyrestis*

thyodamas, Boisd., in splendid condition. This, a Nymphalid, by the possession of a well-marked anal lobe to the hind-wing suggested the *Rapala* group of Lycaenids, but a close examination of the veins shows that neither lobe nor tail is homologous in the two widely separated genera. In addition to the above a second *Caduga tytia*, Gray, was secured, the first having been netted 1000 ft. higher. This blue and black Danaine is distinguished by having brown hind-wings. Time was, however, getting on, and my sais was waiting with the pony by the little bridge, so I reluctantly mounted. I had not ridden far when I caught a glimpse of *Kallima inachis*, Boisd., flying by the roadside; flinging myself out of the saddle I was fortunate in netting *the* butterfly of all others that I had wished to see alive. It proved to be a fine female; to wait to see in what attitude she would settle would have involved too great a risk, and alas! no more were seen. A few minutes later my sais brought me a damaged *Euploea* with a lovely purple gloss; seeing many about (in spite of my uncle's advice[1]) I foolishly did not keep it.

These things happened close to the Tísta bridge, by which the road to Lhasa crosses the river, here only some 650 ft. above the sea, so deeply are these Himalayan valleys cut down. Sad to say in a few minutes the winding of the road took me under the deep chill shadow of the mountain and the purple-glossed *Euploeae* and nearly all the other butterflies vanished for that day. A solitary *Neptis aceris*, together with a few *Ixias pyrene*, *Huphina nerissa* and *Lampides elpis*, were all that I saw; with them was a Hypsid day-flying moth, *Trypheromera plagifera*, Walk.

The rest-house at Riang was reached too late for any more collecting, so I had to content myself with watching the long trains of Colonel Younghusband's bullocks painfully dragging wagon-loads of compressed hay for the Tibetan expedition. Alas! for the once fair road, now a foot deep in white dust.

December 19th. It was such a long march from Riang by way of Mongpu and Sareil back to Darjiling that little time could be given to collecting, moreover many hours were spent passing along a beautiful forest track in the deep afternoon shadow of the mountain. At the start, close to the river, the silvery-white *Acropteris vagata*, Moore, the only Uraniid that I came across, was conspicuously spread out upon a leaf. Near Mongpu, at about 3000 ft., *Ergolis merione* was very common about the Castor-oil plant, *Ricinus communis*, upon which its larva feeds. A little higher up I came across *Ticherra acte*, Moore, a Lycaenid with very long tails that wave with the wind;

[1] See above, p. 5.

it has a swift jerky flight. The hind-wing of this species is much plaited, but the anal lobe is rudimentary.

Other captures were *Huphina nerissa*, a male; *Ganoris canidia*, a female with all the hind margin of the hind-wing gone; *Tachyris hippo*, Cram., a male; *Arrhopala rama*, Koll.; *Neptis astola*; *Ilerda epicles*, with all the hinder part of the hind-wing apparently bitten off by a lizard; *Cirrhochroa aoris*, Doubl., which I had seen at Pashók on the previous day; *Lethe rohria*, very like *Pararge aegeria* in its habits and liking for shade; and *Argynnis hyperbius*, this last in the Cinchona plantation at about 3600 ft. A large white butterfly, bright yellow underneath, fluttering at the sweet white flower of the Cinchona, led me to dismount, and it was well that I did so, for it turned out to be *Prioneris thestylis*, Donbl., and fortunately a female; this must be very much the less common sex, at any rate the Hope Collection contained no female of the genus.

All the afternoon was spent in a somewhat weary ride along a very bad track through the forest. Many of the trees were immense, and up their huge boles crawled large-leaved creepers such as I had never set eyes upon before. It was chill and dark with scarce a butterfly to be seen, but I caught sight of a mammal which I took to be a Civet Cat.

The next day, December 20th, I rode down to the Ranjit River, the boundary of Sikkim, *the* great Papilio country. Unfortunately the distance to be traversed reduced my actual collecting to less than four hours.

At about 3000 ft. I took two of the Erycinid *Zemeros flegyas*, also *Symbrenthia lucina*. The chief collecting-ground was near the suspension bridge leading into Independent Sikkim, closed this year (1903) to all Europeans, including entomologists, on account of the Tibetan difficulty. It was trying to a European temper to be stopped by a coloured policeman, while natives passed freely over.

Here, some 800 ft. above the sea, the first thing that I happened upon was *Danaida chrysippus* in extreme abundance in a very limited locality, it was in fact decidedly gregarious. By the way, pinching and cyanide are both but very imperfect ways of slaying these tough-skinned Danaines.

Elymnias undularis, both sexes, was common, but I did not see any *D. plexippus* for its female to mimic; although the under-side of this butterfly is leaf-like, it is, as a fact, usually conspicuous when settled. I caught distant glimpses of two Papilios and missed my first *Hebomoia*, in fact the things that I missed that day would have made quite a good collection.

The following were all common: *Huphina nadina* and *H. nerissa*, both males; *Ixias pyrene*, large; *Neptis aceris; Precis iphita*, spreading itself out like a *Eupithecia* when settled; *Symbrenthia lucina*, and *Lampides celeno*, while *Terias hecabe* was both abundant and large.

Other things taken were *Ypthima marshalli*, Butl., and *Orsotriaena meda*, Fabr. (*runeka*, Moore), a very dull butterfly. In marked contrast was *Jamides bochus*, Cram., the male iridescent dark-blue above, quite gem-like, beneath dull grey with a metallic ocellus at the anal angle of the hind-wing; the female is comparatively dull in colour.

That day for some reason I missed a larger proportion of the good things than usual, but managed to catch the following:—*Prioneris thestylis*, a male; *Cirrhochroa aoris*, looking on the wing like a big *Argynnis*, but settling with wings half-expanded, several seen, but only one netted; a *Charaxes* (*Eulepis*) *athamas*, Drury, taken on a flower, was the only individual of the genus that I got in all my travels. Another specimen of this very distinct and beautiful species was seen feeding upon human ordure. Fear of fouling my net prevented me from striking down upon it, and it suddenly darted up, went twice round with a swift jerky flight and then disappeared. Mr. Möller had indeed told me that *Charaxes* was a very foul feeder.

The elegant day-flying Moth *Trypheromera plagifera* must be added to my list, as well as the little Geometer *Psilocambogia memorata*, Walk., which I found dead, caught and set out upon a burr of some Composite flower; lastly a Beetle, *Mimela horsfieldi*, Hope, of brilliant green with coppery tinge.

The extraordinary abundance of Dragon-flies of many kinds at the Ranjit River was remarkable, yet I did not once see a butterfly attacked by any of them.

I left Darjiling on December 22nd, with much regret, and a strong desire to return at a better time of the year. On the way down, at about 4000 ft., *Ixias pyrene* was common, while close to Tindaria station, at about 2900 ft., I netted from the train *Cyaniris dilectus*, Moore, a pale Blue with a whitish patch on each wing, as well as another Blue, *C. ladon*, Cram., f. *pseudargiolus*, Boisd., and an Acidaliid, *Idaea remotata*, Guen.

At TINDARIA I left the train and walked down to Sukna. The following things were met with: (1) At altitudes of from 2800 ft. to 2000 ft.:—The Erycinid, *Zemeros flegyas*, almost abundant, but rather worn; *Mycalesis indistans; Precis lemonias*, a small specimen in fine condition, also large ones worn (this and *P. iphita* were the

only species of the genus captured in the Darjiling district); single examples of *Neptis aceris, N. astola* and *N. varmona; Symbrenthia lucina,* common; *Lampides celeno* form *alexis,* also common; *Ganoris canidia,* a female; *Huphina nadina,* a male, about 3000 ft.; *H. nerissa,* a male, about 2500 ft.; *Tachyris hippo,* a very fine female; *Terias hecabe,* abundant, two males, one of them dwarfed, were of the variety without the "dog's head."

(2) At altitudes of 2000 ft. to 1500 ft.:—Here I took *Catopsilia pyranthe,* a male; *Yphthima marshalli,* two; *Huphina nerissa,* worn males, common; *Precis lemonias,* several; *Terias libythea,* common; and the Blue, *Zizera otis.*

At about 3.30 p.m., I watched a fine specimen of *Papilio aristolochiae* flying very slowly about herbage, apparently seeking for a resting-place for the night, just as I had seen *P. pammon* doing at Kháirna on November 18th; near the same place I missed two specimens of a black and white Danaine.

(3) A little way above Sukna, perhaps at about 700 ft. above sea-level, *Orsotriaena meda* was in the greatest abundance in a deeply-shaded wood; this typical shade-lover is sluggish, yet it was on the move later than most things (for it was just before sundown), but when kicked up from ferns or other low herbage it did not fly more than two or three yards. It varies greatly in the pale streak on the under-side, which may be white and very conspicuous or almost obsolete; this is quite independent of season, for my specimens were all distinctly "dry." One specimen exhibits a well-marked bite out of the hind margin of both hind-wings above the anal angle, the injuries on both sides corresponding closely.

It was dark when I reached Sukna station, 500 ft. above sea-level, and fireflies, *Luciola* sp., were flitting about on all sides. A flare, lighted just before the arrival of the train, attracted many moths, of which I secured a large sharp-winged transparent Pyrale, *Cydalima conchylalis,* Guen.; and the wide-ranging Noctua, *Prodenia littoralis* Boisd. In the train, immediately after starting I bottled a male winged ant, *Dorylus juvenculus,* Shuck., one of the most strange-looking insects that I have met with.

Thus closed my short Darjiling campaign, and leaving behind with much regret the Buddhist priests and their prayer-wheels, the cheery but dirty Lepchas and Bhutias, with their turquoise-bedecked women folk, and above all the awe-inspiring Himálaya, we steamed away into the darkness over the monotonous plain of Bengal.

BANKÁPÚR, lat. 25° 30′ N., alt. *circa* 250 ft.

December 22nd, 1903—January 3rd, 1904.

In absolute contrast to Darjiling, BANKÁPÚR, the civil station of the great city of Patna, is situated on the level, monotonous, and highly-cultivated plain of the Ganges, affording little harbour for butterflies, so that a fortnight's stay with old friends at the hospitable parsonage yielded small entomological results.

In spite of these unpromising surroundings, *Danaida chrysippus* was common, and in company with it *Hypolimnas misippus*, of which I saw several males and secured one female, the latter such a close mimic of *chrysippus* that even the small white spots on the thorax and head are reproduced.

Of *Tirumala limniace* I saw a solitary example, of *Crastia core*, two; but the other very common Danaine, *Danaida plexippus*, was abundant in a mango orchard, and distinctly gregarious in its habits. It has rather an unpleasant scent, but whether or no it is confined to one sex I unfortunately did not notice.

The Satyrids were represented by a solitary *Mycalesis perseus*; the Swallow-tails by *Papilio pammon*, worn, *P. aristolochiae*, and *P. demoleus*, the last a specially flower-loving species. *Precis* was represented by four species: *almana*, one of them with large pieces, in part corresponding, bitten out of each hind-wing; *oenone*, one; *lemonias*, several; and *orithyia*, several, the latter all small. Single specimens of the common and generally distributed *Atella phalantha* and *Ergolis merione* were seen in gardens. A fine *Limenitis procris* was taken sipping toddy from a palm; the first shot missed him, but he foolishly returned to his fatal liquor.

Of *Catopsilia pyranthe* I took two males and a female. One of the former when held fluttering beneath my nostrils gave out a strong scent that instantly brought greenhouses to my mind, then my own greenhouse, then *Polianthes tuberosa* (barbarously termed by nurserymen "Tuber Rose."), and lastly Jasmine. I do not think that I ever smelt so distinct a scent in a butterfly, always excepting the male of *Ganoris napi*. The other male *pyranthe* I held under my nose while I stroked the "feather-tufts" of the hind-wing; this at once elicited the odour of jasmine, further confirming the observation of Wood-Mason.

Two males of *Huphina nerissa* bear the following notes: "Scented, not like *napi*, more like *rapae*;" and "this specimen had a scent like *P. rapae*, i.e. of the sweet-briar type." Again a *female* of *Delias*

eucharis (which was common) bears the note, "has a scent much like *rapae*," and the specimen appears to have been wilfully rubbed. My observations on butterflies in England show that in some cases *females* have a scent, but not like, or as strong as the males. My strong impression is that the *male* of *D. eucharis* has the *rapae*, or sweet-briar scent.

The three species of *Terias*, viz. *hecabe*, *libythea*, and *laeta*, were all common; one of the *laeta* appeared to have been bitten by a bird.

Nychitona xiphia was not uncommon, and several *Ixias marianne* were seen. *Chilades varunana* (according to de Nicéville the wet-season form of *C. laius*) was common about irrigated flower-beds, indeed Blues are wonderfully fond of water. The only butterfly seen at Bankápúr that was at all out of the common, besides *Limenitis procris*, was the large grey Lycaenid *Virachola isocrates*, Fabr., of which I took one at flowers in the Commissioner's garden. I noted that its hind-wings were much folded posterior to the tails, the convexities of the folds being towards the upper surface. These foldings of the wings are not well seen in set specimens.

Although Bankápúr is far from being a good locality, it will give some idea of the abundance of butterflies in India when I say that in mid-winter, December 24th, I took in a suburban garden within three-quarters of an hour no less than ten species, some of them represented by numerous individuals.

BUDDHA GÁYA, lat. 24° 42′ N., alt. *circa* 500 ft.

December 30th and 31st, 1903.

Though the revived cult of Buddha has no attractions for me, it was impossible not to be stirred at visiting another of the places especially consecrated to his memory.

The temple marks the spot where Gautama sat in meditation under the Pípal, or Bo-tree, until he became Buddha, the Enlightened One, something like 2500 years ago. The present Bo-tree (*Ficus religiosa*) does not appear to be very old, but that at Anurádhapúra, in Ceylon, which is stated to have been a slip of the original tree, is very much older. Some portions of the stone "rail" placed round the tree by the Emperor Asoka, about 250 B.C., still remain. The low reliefs carved thereon are very Greek in character (like most of the early Buddhist sculptures of Northern India), and the Hindu guide showed us what appeared to be a representation of Apollo with four horses driving the Sun. This guide, a bábu of the Public

Works Department, kindly patronized Christianity, Buddhism and Brahmanism alike, and displayed his superiority to all three religions by quoting Auguste Comte and Herbert Spencer.

The vicinity of the shrine and its sacred Bo-tree was by no means productive, but the next day, on a steep hill of red trap rock, overlooking the town, I saw for the first time the Acraeine *Telchinia violae*, Fabr., on the wing it reminded me of *Argynnis euphrosyne*; it was locally abundant and gregarious, its tone of colouring harmonizing with the red igneous rock. On the same hill were two or three *Precis oenone* and several small *P. orithyia*, while *Zizera otis* was abundant.

In the course of this walk I noticed a Fakir, or religious mendicant ascetic, watching my operations with evident suspicion, probably owing to the reverence in which some of these folk hold all animal life. Presently a small native boy threw a stone at a squirrel. I thought better of the Fakir when he cursed the boy so fiercely that he fled in terror as fast as the squirrel, while I rolled up my umbrella-net and passed on, trying to elude observation!

MOZUFFARPÚR, lat. 28° 8′ N., alt. *circa* 300 ft.

On a flying visit, January 2nd, 1904, to this place, nearly north of Bankápúr, I took in the Judge's garden two *Zizera otis*, and one *Z. maha*. It was at the gate of this very compound that a few years afterwards a bomb, intended for my host's successor, killed two ladies.

JHÁNSI, lat. 25° 30′ N., alt. *circa* 750 ft.

January 5th—13th, also 21st, 1904.

Situated on a sandy plain, broken by precipitous ridges of igneous rock, JHÁNSI, something like 750 ft. above the sea, is characterized by dryness, heat, and sparseness of cover.

As in other Indian stations the Kite and the Vulture are most important officials of the Sanitary Department. More friendly are the chattering black Máinas in every garden; but, after all, *the* characteristic bird of India is the grey-headed Crow, which, always consequential, hops solemnly about as if everything in city and country alike belonged to him, and he was responsible for it.

Among the butterflies a couple of *Papilio aristolochiae* taken at flowers near the lake were the sole representatives of their family. Several *Belenois mesentina* were captured, but it was scarcely common; the male had a distinct, but faint, sweet scent; on the

ridge of Retribution Hill (where Sir Hugh Rose in 1858 slew 2000 mutineers), I took a female *B. mesentina* in which the hind-margins of the hind-wings had been symmetrically broken off, probably by the bite of a lizard. Of three specimens of *Terias hecabe*, one, a small female, was of the variety without the "dog's head" notch. Of *T. libythea* a single specimen was taken, but *T. laeta* was plentiful and of gregarious habits. *Teracolus etrida* was locally rather common, especially the female. On the other hand, the male of *Ixias marianne* was rather common.

Two *Atella phalantha* were taken; the only *Precis* noted was *orithyia*, and that very dwarfed, one individual measuring only 1·4 inches across the wings.

Telchinia violae was abundant at the foot of Retribution Hill, and scattered specimens occurred elsewhere. This insect, like the Danaines, has a tough skin which enables it to resist pinching, and doubtless makes it indigestible. When injured a yellow juice exudes; a minute drop of this placed on the tongue tasted somewhat bitter and disagreeable, but the flavour was by no means strong.

The Jhánsi Lycaenids were fairly numerous, but not very brilliant, the most remarkable was *Chilades putli*, for it is actually smaller and darker than our *alsus*; other species were *C. laius*, which appears to have been common, but of which I unfortunately took but one specimen, and *Catochrysops contracta*, Butl., of which I took two; *Tarucus theophrastus* was common, the two sexes are, on the upper surface at least, very different, and *T. telicanus* was also noted as common, though I secured only one of each sex. Blues are very abundant in India, but they are very much alike, so that being ignorant of the distinctions between allied species, one was but too apt to neglect them while in the eager pursuit of larger game. For these reasons too much weight should not be attached to the observation that such and such a species was common or abundant, but the qualification, "or something superficially like it," should be added.

Two moths came to light, the Agrotid *Euxoa spinifera*, Hübn., and the *Macaria*-like *Semiothisa frugaliata*, Guen. Besides these I took a brown beetle, *Bolboceras quadridens*, Fabr.

After prolonged drought there was a heavy rainstorm at Jhánsi, on January 14th, and there was slight rain at Gwálior on the 16th and 17th. With the exception of a very few days with clouds and occasionally a few drops of rain, there had been almost uninterrupted sunshine for three months, *i.e.* since October 8th. On January 20th, writing to Dr. Dixey, I said, "There has been a very cold 'wave' in

Northern India with a few showers of rain, but scarcely enough of the latter to affect either vegetation or insects." On January 23rd there was gentle rain at Jhánsi lasting several hours.

At Gwálior, on January 15th, an untoward circumstance was near bringing the author to an untimely end. The splendid rest-house erected by the hospitable Máharájah Scindia for the accommodation of European visitors was full, but His Highness soon set up and placed at our disposal one of his own luxurious tents which had been made for the Delhi Durbar. Moreover, we went for a drive round the foot of the rock on which the fortress stands, in a carriage from His Highness's stables, a Victoria drawn by a pair of sturdy transport horses. This carriage had no brake, the military harness no breeching. At one place a very steep road was carried on a low embankment; at the critical point one of the horses refused to pull back, the carriage "took charge" and, after a swerve or two, went over, and we were all pitched out on to a stony bank the other side of the deep ditch—the Victoria across my back!

All, myself included, thought my last moment was at hand: a dull aching suggested a severe internal injury. We had fancied that we were in a lonely spot, but, as always happens in India, coolies seemed to spring up from the ground, and they lifted the burden from my shoulders. A polite Hindu, a pleader of the High Court, came up and said: "By the mercy of God, you are not killed!" This gentleman most kindly sent for a pálki, or palanquin, that he knew of, and despatched other messengers for the Civil Surgeon, who lived some miles away. I was carried back to my tent to await the arrival of Capt. Battye, I.M.S., an old acquaintance, as it turned out, for I had acted as his dresser in a tobogganing accident at Grindelwald some years before. This surgeon, and subsequently two others, failed to find any broken bone, a fact that spoke well for my scapulae, since the other party to the impact—the Victoria—suffered from a comminuted fracture. One of the horses had been injured; the Máharájah, in true Oriental fashion, sent the driver to prison!

So it befell that I was denied the undoubted dignity, but questionable joy, of visiting, on the back of one of the Máharájah's elephants, the interior of the historic stronghold. As I wrote home at the time: "Imagine an island exactly half the length of Lundy, and nearly its height, rising sheer from the dusty plain; along the top of its beetling cliffs a vast wall, nowhere less than 30 feet high, often more, its monotony broken by bold round bastions; carve on the cliffs colossal statues, scatter at intervals palaces, tombs, and temples of the three great Asiatic faiths, and—you have Gwálior."

Strong as it unquestionably is, it has been captured six times—thrice by us. In 1886 it was ceded to Scindia, a Prince always loyal to us, in exchange for Jhánsi, a fort requiring fewer men to hold, and occupying a strategic position of great importance at a railway junction.

During my convalescence I greatly appreciated the skill of my native servant as a *masseur.*

By January 21st, though still suffering, I was just equal to another day's collecting at Jhánsi, but the species taken were not such as to show any change of type due to rain, even if such change had been possible. The insects met with were *B. mesentina, I. marianne, T. etrida, A. phalantha,* and *T. theophrastus.*

Orchha.

On January 9th we visited this fine deserted city, some eight miles to the east of Jhánsi; it was once the capital of the native state of Orchha, and its bridge and castle are among the finest in India. During an hour's collecting I took or saw *Danaida plexippus, Precis lemonias, P. oenone,* and *P. orithyia* (this last in abundance); *Atella phalantha,* an *Ixias, Teracolus etrida,* a *Terias,* and several female *Belenois mesentina.* Monkeys were almost as common as butterflies among the ruined tombs.

Barwa Ságar.

On January 14th, I got a couple of hours' unproductive collecting in the neighbourhood of the interesting and romantically-situated old castle of this name, which lies some twelve miles to the east of Jhánsi. Barwa Ságar, like Orchha, is somewhat off the ordinary route of globe-trotters. The castle stands high, and is approached by a winding road between fine old trees that strangely recalled an English park. We were put up in what had been in the good old days the Zenana, now turned into a Dák bungalow. The whole place suggested rest, and the look-out over the pretty lake with its countless thousands of Cormorants was a pleasant change after dusty Jhánsi.

Here I observed in two specimens of *Danaida chrysippus* (of which certainly one was a male) a distinct cockroach-like odour, sufficiently strong to be perceptible when the insect was fluttering in the net. Of *Catopsilia pyranthe* I took a female of the *gnoma* form; of *Terias hecabe* a male, the variety without the "dog's head" mark;

T. laeta was quite abundant. Two specimens of *Huphina nerissa* were taken, one worn, the other a dwarf. The male of *Belenois mesentina* was common; in two specimens I detected a sweet scent like that of *P. rapae*, but more or less faint. A *Polyommatus baeticus* completes the list.

AGRA, lat. 27° N., alt. 550 ft.

January 25th and 26th, 1904.

The sight-seeing centre of India afforded neither time nor place for entomological research, and the few butterflies noted were of the most familiar Indian forms. While at AGRA one lived in imagination with Akbar and Shah Jehan, and tried to imagine the charms of the fair lady who, one of many, the "Chosen of the Palace," inspired her husband to erect over her mortal remains by far the most beautiful tomb that has ever been built. Surely the Táj Mahál is an enduring proof that true love is compatible with polygamy. In discussing the beauty of the Táj two things are needful. In the first place the monument must be considered as a whole, with its walls and mighty gateway, its garden, its pavilions and mosques, as well as the tomb itself.

Secondly, to an Englishman who from his youth up has associated white marble with vulgar mantelpieces, and still more vulgar tombstones, it takes time, repeated visits in the morning, at sunset, and by moonlight, before he grasps what a lovely material white marble really is, and what a glorious result it may produce when, as at Agra, Italian beauty of detail is grafted upon Moghal grandeur of conception. In short, disappointing at first, the beauty of the Táj grows upon the visitor till it becomes almost overpowering.

Parts of the great fort are as beautiful as the Táj, "but," as the guide said to the writer, "your honour is experienced old man, you know everything."

FATHIPÚR SIKRI.

January 28th and 29th, 1904.

The reign of Akbar the Great practically coincided with that of our Elizabeth. During his long reign he conceived and carried out the idea of this wonderful city, but almost as soon as it was built he abandoned it, as the water supply was defective. Consequently it remains to this day, as it were, a vast red-sandstone fossil city, the Pompeii of India. Akbar was the most tolerant of sovereigns, his

wives—Christian and Hindu as well as Moslem—were allowed freedom of worship, and he even built temples for them. His tolerance is shown to this day by his architecture, a strange but beautiful mixture of Hindu with Mohammedan. Incidentally it affords evidence that in India, as in Japan, the art of the carpenter preceded that of the mason, whereas in Europe the reverse was the case. In Akbar's great tomb near Agra the general design is obviously based on timber construction, while at FATHIPÚR SIKRI some of the most beautiful of the smaller buildings, entirely constructed of the celebrated sandstone of the place, exhibit undoubted imitation of wood construction in the eaves, while the stone slabs covering the roofs are carved so as to resemble tiles.

Here I found, most appropriately, that those ruin-frequenting butterflies, *Belenois mesentina* and *Teracolus etrida*, were both common, but all appeared to be males. The *Belenois* had a faint, sweet, flowery scent, which did not appear to me to be quite like that of any other insect. I took also one *Teracolus puellaris*, a female, and a most ferocious wasp, *Eumenes dimidiatipennis*, Sauss., a female.

There were no Monkeys among the ruins, but I saw a Hare. Countless Doves coo-ed continually, and from time to time a Jay was seen, brilliantly coloured in two shades of blue, like a piece of Múltán pottery.

I asked the caretaker of Akbar's tomb what was the purpose of a certain pavilion, and he answered, "Band-stand, music-hall, tom-toms!"

AJMIR, lat. 26° 30′ N., alt. *circa* 1800 ft.

February 4th and 5th, 1904.

The crowds in the streets of AJMIR and JÁIPÚR, the only cities of Rájpútána that I visited, afforded a wonderful display of colour, such as I did not see elsewhere.

The most notable capture here was *Teracolus fausta*, Oliv., of which I only got one male, a poor specimen, missing two others; it has a very distinct orange look on the wing, and I feel sure that I saw one on January 22nd at Pálipahári, the artillery practice-camp near Jhánsi. Of *T. etrida* I took two males, one of which had lost the apex of the left fore-wing and all its hind-margin, as well as the apex of the left hind-wing. This is notable as possibly being an attack on a "direction mark."

I saw several battered *Precis oenone*. The smaller fry were

represented by a neat little chequered Skipper, *Hesperia galba*, Fabr. The emerald-like *Stilbum splendidum*, Fabr., turned up both here and at Jáipúr, and did its best to gratify the Rájpúts' love of brilliant colour, for the little Cuckoo-wasp is as brilliant, though of course not so effective, as the numerous wild Peacocks that sat in twos and threes upon the railway fences.

On Táragarh, the precipitous hill that overtops the city by perhaps 500 ft., I got only *Belenois mesentina*, *Terias laeta*, and a long-waisted female wasp, *Eumenes dimidiatipennis*.

MT. ABU, lat. 24° 30′ N., alt. of civil and military station *circa* 4100 ft.

February 6th—8th, 1904.

Insects were extremely scarce upon the sacred Jaina mountain. The commonest butterfly was *Terias laeta*; it was abundant up to 4500 ft., and the only representative of the genus seen. These, together with *Belenois mesentina*, *Huphina nerissa*, a few *Precis lemonias*, and a couple of *tages*-like Skippers (which I missed upon rocks at about 4400 ft.), were the only butterflies that I saw on the elevated plateau. One moth, the very widely-distributed Crambus, *Eromene ocellea*, Haw., came to light.

At lower elevations, on the fine road up from the plain, the following were met with: at about 3000 ft., *Belenois mesentina*, *Tarucus telicanus*, and *Polyommatus baeticus*, the last as usual in poor condition. From 3500 ft. down to 2500 ft. a few *Yphthima inica*, Hew., were seen, and at about the last-named elevation, among the rocks of a nearly dry water-course, I saw two specimens of the beautiful Nymphalid, *Symphaedra thyelia*, Fabr., but only secured one; unfortunately time was pressing, or I might probably have taken more; it has the habits of a *Vanessa*.

The temple of Vimála Sah, built wholly of white marble which must have been transported 300 miles, and then carried 4000 ft. up the granite mountain, is a marvel of beautiful work. Its special characteristic is the delicately wrought pendant under the dome, built, mind you, in the eleventh century, anticipating our Gothic builders' efforts in the same direction by close upon five centuries. The hundreds of figures of Buddha, all exactly alike, show how far a religion can depart from the ideas of its founder.

BOMBAY, lat. 19° N., near sea-level.

February 10th, 1904.

In an hour's visit to the Victoria Gardens, where insects were fairly numerous, I got *Papilio demoleus*, *P. aristolochiae*, *Neptis varmona*, and *Nepheronia hippia*, a female, the last-named mimicking *Tirumala*.

On February 15th I was much interested in watching the movements of a solitary butterfly in the small public garden of the University, in the heart of the city. It appeared to be a large *Catopsilia*, possibly the *catilla* form of *pomona*, but at any rate of a general greenish-yellow colour; when disturbed it invariably settled in one or other of several small shrubs with yellow leaves, when it would vanish quite suddenly. It was only after several attempts that I succeeded in getting a glimpse of it when settled, so strong was the protective resemblance.[1]

BIJÁPÚR, lat. 17° N., alt. *circa* 1500 ft.

February 16th and 17th, 1904.

This was further south than I had yet collected, but the scanty vegetation among the ruins seemed too parched to yield very much. The most prevalent genera here, as at so many places where thorns, burrs, rocks, and ruins predominated, were *Belenois* and *Teracolus*, the last a genus which, though beautiful in the cabinet, is not effective on the wing.

Teracolus etrida was abundant, the males appearing to be about twice as numerous as the females; they varied greatly in size, so much so that among the males the largest had nearly double the alar expansion of the smallest. Of *T. dulcis*, Butl., I took one female, and of *T. amatus*, Fabr., var. *modestus*, Butl., two males.

The only *Terias* seen was *laeta*. *Belenois mesentina* was abundant; a slight sweet scent was detected in one specimen.

Catochrysops strabo was common, also *Polyommatus baeticus*, one specimen having lost two-thirds of each hind-wing, presumably the work of some enemy; of *Zizera karsandra*, I took one.

At night several moths came to light, viz., *Lymantria incerta*, Walk. (*Enome detersa*, Walk.), the Geometers, *Tephrina disputaria*,

[1] In April, 1908, I walked through this same garden and watched a *Catopsilia* settle twice, each time on a *yellowish* leaf, apparently selecting the yellowest available.

Guen., and *Idaea* (?) *fibulata* Guen. (worn), and the very widely-distributed *Etiella zinckenella*, Treit.

A ferocious-looking Arachnid, a *Solpuga*, shared the Dák Bungalow with us.

Among the many marvels of BIJÁPÚR are the monster cannon: one of these "The Lord of the Battle Plain," cast during the reign of our Elizabeth, has a calibre of 2 feet 4 inches. It was a curious proof of the superstitious reverence which the natives show to anything big, that grains of rice inside the gun gave evidence of recent púja (worship) offered to it.

Another gun, of 12-inch calibre, I take it of much later date, was a forerunner of our "wire" guns, being built up of longitudinal iron bars, round which other bars were spirally wound and the whole forged together. A smaller gun of similar structure in the fort at Jhánsi defied the efforts of our sappers to destroy it.

ANANTÁPÚR, lat. 14° 30′ N., alt. *circa* 1500 ft.

February 18th—23rd, 1904.

This small civil station, situated on an irrigated though elevated plain devoted to the growing of cotton and rice, is typical of Southern India.

A very hot walk to some small granite hills on the other side of the lake produced little beside two males of *Ixias marianne*, and a solitary *Teracolus eucharis*; the hills seemed actually too hot, dry, and parched to harbour butterflies.

About the trees along the dam, or "bándh," were a few *Hypolimnas misippus*, males, and abundance of *Papilio aristolochiae*.

In the cotton fields by the river *Byblia* (*Hypanis*) *ilithyia*, Drury, was to be got, but not plentifully.

The best collecting-ground was a very weedy nursery-garden and orchard. Here I one day had the advantage of the assistance of my host, Mr. Edwin Scott, I.C.S., whose keen appreciation of scents helped me greatly. *Danaida chrysippus* was abundant; of its scent Mr. Scott's first impression was "some sort of dung," then "a zoo"; later he said "possibly like a cockroach, but more like a musk-rat." The scent is, I think, general, but is perhaps stronger when the sacs on the hind-wings are opened: a fact that I also observed at Calcutta.

Crastia core was common and gregarious, frequenting a special Mango-tree. When he smelt this insect Mr. Scott at once cried out

"acetylene," adding that he would like to put a lighted match to it to see whether it would burn! Subsequent observations on the butterfly and the gas convinced me of the accuracy of his comparison. The genital organs appear to exude the scent, probably the long tufts appended to them.[1]

At this place I confirmed in two specimens of *Catopsilia pyranthe* the jasmine odour connected with the "scent tufts" of the male, but did not find it as strong as in specimens of the same species examined at Bankápúr six weeks before. Mr. Scott agreed to the comparison with jasmine, but thought the scent was perhaps even more like that of *Polianthes tuberosa.*

I also examined two males of *Tirumala limniace* for scent, but was unable to elicit any from the prominent sacs on the under-side of the hind-wings, although I suspected some to be emitted by the genital tufts.

Papilio demoleus was frequently met with, and *P. aristolochiae* was common, but I only took a single *P. pammon.* Although the male of *Hypolimnas misippus* was fairly common, I saw only one worn female; this was of the very marked variety *inaria*, Cram., in which the white marks near the apex of the fore-wing are entirely wanting, and the black tip is reduced to a narrow border, so that it closely mimics *D. chrysippus*, var. *dorippus*, Klug, a form which is very rare in India. Several times I saw the male *H. misippus* reconnoitring *D. chrysippus* as if in doubt as to its identity.

Of *Precis oenone* I took but one, of *P. almana* two, but *P. lemonias* was common. Of the following species I took mostly single examples:—*Danaida plexippus; Ergolis ariadne; Neptis eurynome*, Westw.; *Polyommatus baeticus; Lampides celeno*, f. *conferanda*, Butl.; *Catochrysops hapalina*, Butl., two; *C. strabo; Zizera otis*, f. *indica*, two; and the Skipper, *Suastus gremius.*

Of *Melanitis ismene* I took but a small fraction, for one seldom sees a butterfly so battered, yet even this fraction was found in the shade. In marked contrast are the habits of *Telchinia violae*, since it haunts the most sun-scorched places; it was not uncommon at Anantápúr, but if gregarious, as elsewhere, then I did not hit upon its headquarters.

I took one *Terias libythea*, and saw several *T. hecabe*, though it was but moderately common.

Cephonodes hylas, Linn., an insect very like *Sesia bombyliformis*, Esp., was two or three times seen, and once caught, hovering at flowers. There were also flying in the sun *Utetheisa pulchella* and

[1] See, however, Chapter X., § I.

Trigonodes hyppasia, Cram., a Noctua very like *Hydrelia unca*, Linn., which reminded me of Headington and old Oxford days.

Out of the grass I kicked up *Tephrina catalaunaria*, Guen., a pretty little Macariid Geometer *Semiothisa subalbitaria*, Swinh., and *Sterrha paullula*, Swinh. The common dragon-fly, *Orthetrum sabina*, Drury, and a bug, *Eysarcoris guttigera*, Thunb., completed the tenants of the garden.

A number of things came to light, viz.:—*Utetheisa pulchella; Lymantria incerta*, Walk.; a Noctua, *Ericeia inangulata*, Guen.; a Pyrale, *Schoenobius bipunctifer*, Walk.; and a tiny Quadrifid Noctua, *Raparna digramma*, Walk. (*lactea*, Swinh.), as well as two Bugs, *Acanthaspis apicata*, Dist., and *Dieuches uniguttatus*, Thunb., the former apparently a scarce insect since the National Collection contains the type only. There was in addition to these a small ochreous narrow-winged Geometer to which I have not been able to assign a name, and an Ichneumon-fly, *Henicospilus* sp. One evening insects came to light in swarms, among them were many Mosquitos, but from their attitude these appeared to be all *Culex*, fortunately none of the ague-carrying *Anopheles*.

Bangalúr, lat. 13° N., alt. 3100 ft.

February 23rd, 1904.

The change of trains at this large military station gave me a couple of hours collecting in the extensive public gardens. A high wind was against a good day, but the afternoon proved interesting since it gave me the first glimpse at that fauna which is, to a great extent, common to Ceylon and Southern India. Here I saw for the first time that very striking black, white, and orange Lycaenid, *Talicada nyseus*, Guér., as well as the huge and magnificent *Papilio polymnestor*, Cram., 5½ inches in expanse, a truly gorgeous monster in which pale lilac is the prevailing colour, trimmed with black.

The only other things noted were more ordinary, to wit *Catopsilia pomona*, a female; *Crastia core;* several *Telchinia violae; Nychitona xiphia;* and an abundance of *Neptis eurynome*, accompanied by one *N. jumba*, Moore, quite a distinct species.

The Nilgiris, lat. 11° N.

February 24th—March 3rd, 1904.

The Nilgiris, or Blue Mountains, rising abruptly from the plain, itself nearly 2000 ft., above the sea, form a rolling table-land with

an average altitude of from 6500 to 7500 ft. This plateau consists for the most part of grassy downs with here and there "sholas," or thickets of mixed growth, very beautiful at this time of the year owing to the red colour of the young leaves of the preponderant tree. Unfortunately, alike for the entomologist and the artist, these "sholas" have been largely cut down to make way for the extensive Government plantations of Eucalyptus, which are by comparison dull, dreary and monotonous.

On the way up the cog-wheel railway I saw on the side of the cutting two beautiful blue-green Papilios, which may have been either *P. telephus*, Feld., or *P. teredon*, Feld. At about 4500 ft. I netted a *Neptis eurynome* from the train in motion.

It was evidently too early in the year to get many butterflies at Útakamand, the elevation making the nights cool, so it was necessary to seek out sheltered flowery banks facing south, or preferably south-east. In two such spots within a very circumscribed area *Talicada nyseus* was common; a single example also occurred (along with the inevitable *Pyrameis cardui*) on the grassy top of an isolated and exposed peak of about 8000 ft. This Lycaenid is quite typical of South India and Ceylon; it is a conspicuous insect on the wing, its tricolour of black, white and orange-red (which should delight German entomologists), making it look larger than it really is.

Terias hecabe was rather common, but worn. A female *Polyommatus baeticus* and several *Pyrameis indica* were also old friends, and the same applies to two or three *Papilio aristolochiae*, which were a good deal the worse for wear, seen at flowers in the hotel garden.

A few *Yphthima chenui*, Guér., occurred at about 7800 ft., the only Satyrine I met with at Útakamand. *Ganoris canidia* flew up to 8000 ft.; a male had a distinct smell like that of our *G. rapae*. I submitted the living butterfly to my daughter and her lady friend, who both noticed the scent, though unable to describe it. When mignonette was suggested for comparison they both said "No"; but when sweet-briar was mentioned they said it was like that, my daughter speaking the more confidently of the two.

At about 7400 ft. I took a female *Catophaga paulina*, Cram., and also a fine female of *Hiposcritia narendra*, Moore, quite a Ceylon species. The specimen is labelled "flies fast: rather common from 7400 ft. to 8400 ft." It is but too evident that I had not recognized that I was catching anything out of the common, and it is more than probable that I confounded the females of *Catophaga* and *Tachyris* with *Hiposcritia*, so that I am not by any means disposed to trust the statement that *H. narendra* was common then and there. One

necessary consequence of my complete ignorance of the Indian fauna was that I did not know what was most worth catching. These white butterflies are, as a rule, by no means easy to catch, and were often in bad condition, but in each locality I used to endeavour to secure one or two good samples. Doubtless the *Hiposcritia* passed for a very fine *Tachyris*.

Amongst herbage *Mecyna polygonalis*, Hübn. (a rarity in Britain), was often kicked up, having much the habits and appearance of my old Bermuda and Mortehoe friend *Nomophila noctuella*, Schiff. (*Stenopteryx hybridalis*, Hübn.), which too was fairly common in exposed situations at about 8000 ft.; at a similar elevation a single example of the Danaine *Badacara nilgiriensis*, Moore, was taken.

Above the Botanic Garden on the road to Dodabetta, at about 8000 ft., I several times saw, but missed, *Vanessa canace*, Johanss. (*haronica*, Moore), a butterfly that looks dingy in the cabinet, but on the wing looks much brighter and bluer than would be expected. It is sometimes called the Blue Admiral (completing the trio), though in truth it is much more like a Tortoise-shell. *Argynnis hyperbius* was common at the higher elevations, and in exposed situations up to 8500 ft., reminding me of *A. aglaia*. It flew up and down the roads, returning again and again to the same spot.

The commonest and most characteristic butterfly of Útakamand was the pretty little *Colias nilgiriensis*, Feld., which was seen coursing over the grassy downs from 7300 to 8600 ft. Its flight is moderately fast, but quite close to the ground. It was somewhat startling, but in a way refreshing, to come across this Arctic survival so far within the tropics, associated, moreover, with species characteristic of Ceylon. The late Col. Bingham considered *nilgiriensis* to be a local race of *hyale*, *auct*. As it was especially abundant in the hotel garden I took the opportunity of examining five males for scent; in two of them I suspected the existence of a slight scent, but in the remaining three the result was negative.

From Útakamand I moved to Konúr, which stands on the southern edge of the plateau, overlooking the plain. It is at about 6500 ft. above sea-level, or 1000 feet lower than Útakamand. At this elevation *Colias nilgiriensis* was not nearly so common as at the higher levels.

Worn *Pyrameis indica*, a few *Neptis eurynome* and *Precis iphita* turned up here and there. Of a pair of *Terias hecabe* taken *in copulâ*, the male proved to be of "intermediate dry," the female of "pronounced dry" type. Opportunities of noting the pairing of the several forms occurred very rarely. Here I secured one specimen of

Yphthima ceylonica, Hew., another foretaste of the great southern island. *Y. inica*, turned up at about 5800 ft., but at about 6500 ft., in a clearing in a wood, I found *Y. hübneri*, together with *Y. chenui*, and *Y. philomela*. There were swarms of these *Yphthimas* on that sunny bank, but as I did not distinguish the species at the time I cannot now say of what the bulk of them consisted. Bingham considered *ceylonica* to be a race of *hübneri*, but the other species he held to be distinct. Some of the specimens have injuries to the wings, which from their shapes *may* have been inflicted by birds, but I attach little importance to this, especially as the injuries are unilateral, since the wings of *Yphthima* (and to a somewhat less degree of *Mycalesis* also) are so fragile that quite unbroken specimens are exceptional.

The genus *Papilio* was represented by a couple of *demoleus*. As usual *Argynnis hyperbius* showed a preference for lofty and bare places. On one occasion I watched a female of this species for some time under the impression that it was *Danaida chrysippus!* The resemblance on the wing is greater than might be supposed. *Vanessa haronica*, which had before eluded me so often, fell a victim at last; I secured two specimens on a shady road through a wood. It settles on rocks or walls, a habit that makes it hard to net, moreover it is shy and easily disturbed, though usually coming back again to its resting-place.

True to its generic name, *Nomophila noctuella* was common in grassy places, and I took *Boarmia inceptaria*, Walk., flying in the hotel garden at dusk.

It was tantalizing to be told by the hotel manager at Konúr of the immense number and variety of butterflies there in the summer. I was, however, fortunate in making the acquaintance of a dealer, named Solomon, a coloured man, who told me that at that time of the year it was no good collecting on the high ground, but for a consideration he agreed to show me a very good place near the foot of the hills. Accordingly I went with him on March 2nd, and again alone on the following day. This involved travelling by an early goods-train down to Kallár, the first station on the mountain railway above Mettupálaiyam, about 2000 ft. above the sea, but only 200 ft. to 300 ft. above the plain. Here, as in other parts of India, the best places for insects, at any rate in the winter season, are to be found in the belt of jungle at the foot of the hills, or in the woods on their lower slopes. But it is just in these places where the dreaded *Anopheles* is as abundant as the Rhopalocera, and the station-master at Kallár told me that entomologists always slept at Konúr

and went up and down by train to avoid the nocturnal terrors of the deadly malaria-carrier—the tiny, innocent-looking *Anopheles*.

The collecting-ground was various, and included, besides bushy jungle with plenty of flowers near the station, large irrigated Banana and Betel-nut (*Areca catechu*) plantations as well as the bed of the river with its bordering woods.

The first thing to catch the eye was *Papilio hector*, Linn., and very magnificent he looked fluttering at the flowers of *Lantana* in his crimson and black suit set off with white. This is indeed one of the most striking butterflies that I met with in my travels, with its wings expanding four inches and upwards. It proved to be distinctly common, but the collector does not get within reach of every *Papilio* that he sees, nor indeed does he succeed in netting all that are struck at. *P. hector* was accompanied by plenty of *P. pammon* and a few *P. aristolochiae*. One of the *P. hector* brought home is remarkable for the fact that the whole of the tips and half the hind-margins of both hind-wings have apparently been bitten off, almost absolutely symmetrically, by some foe. If the red spots on the under-side be really "warning marks" this is the more noteworthy.

A boggy, but sunny, corner of an irrigated banana-garden produced single specimens of the fine Skippers *Tagiades atticus*, Fabr., and *Tagiades obscurus*, Mabille (*distans*, Moore).

This same garden and the adjoining plantations of betel-palm yielded a few *Melanitis ismene*, a fair number of *Mycalesis perseus* as well as *Yphthima marshalli* and *Y. philomela*; there was also abundance of the pretty and very distinct *Yphthima ceylonica*, with its silvery-white hind-wings, which tried, not without occasional success, to pass itself off as a Blue. A few hasty observations on this species when at rest failed to detect any such "list" as is common in many members of the family.

From Kallár I sent home two specimens of *Mycalesis perseus*, one an ordinary example of the dry-season form in which the ocelli are indicated by faint dark dots, the other (unfortunately very tattered) in which the full complement of ocelli on the under-surface is indicated by the conspicuous chalky-white spots of varying sizes, to wit, two large and one small on the fore-wings and two large and five small on the hind-wings. Three of these spots are faintly visible on the upper-surface. There are no rings and no pupils to the spots. It would appear to be a unique aberration of the dry-season form. In the shade along with the dusky Satyrs was the inevitable *Nychitona xiphia*. Solomon caught a solitary aberrant male of *Elymnias caudata*, Butl., approximating in colouring and markings

to the female; on the fore-wing, below the median vein, is a longitudinal tawny stripe, while the hind-wing is a lighter tawny colour than usual. Neither Sir George F. Hampson, nor the late Colonel Bingham remembered having seen anything quite like it.

A weedy neglected field near the river yielded, besides *Danaida chrysippus* and *Atella phalantha,* plenty of the Orange-tip *Ixias marianne,* as well as a smaller number of the more gaudy *Ixias pyrene.* One of the latter proved to be a worn specimen of the female lacking the orange tip, a distinct and well-marked variety; another was of the racial form *cingalensis,* Moore. The Whites *Huphina nerissa* and *Catophaga paulina* were in plenty. A single *Catopsilia pomona* was netted, a somewhat papery-looking insect, especially on the under-side; also several *C. pyranthe* of the transitional *gnoma* form. In one of the latter, a male, I detected a faint scent, but less like that of jasmine than in the *Catopsilia* examined at Anantápúr. In the same field *Telchinia violae* was abundant, while *Ergolis ariadne* was, as usual, common among Castor-oil plants.

But all this time Solomon was most anxious to get me down to the river. This is a rapidly-flowing stream, occupying perhaps half its bed, and having on either bank sloping woods of mixed growth. Solomon sought out a place where a tiny tributary emerging from a rushy swamp trickled over the damp sand. He forthwith stuck into the wet sand a foot or so from the rill and well clear of the herbage, three or four large butterflies of which he had netted worn or broken specimens; then he stood by to watch. Nothing much happened, for unfortunately clouds had come up and the afternoon was only partly sunny, whereas to get many things at water, whether decoys be used or not, it needs, as Solomon put it, to be "plenty hot." It was indeed hot enough for most Europeans, but not up to the exacting butterfly standard. However, next day the conditions were more favourable, and I found near what was left of Solomon's decoys a number of Whites and Orange-tips. Accordingly I put down a few more decoys and walked away. After spending some time in vain endeavours to catch the conspicuous *Hebomoia glaucippe,* Linn.—giant of Orange-tips—which was careering wildly about in all directions, I returned to the decoy-place and sat down just within the reach of my six-feet net-stick. *Catophaga paulina* were there in abundance, but all males, mostly sitting quite close together, almost touching, with wings erect so that the "hook-tip" of the fore-wing was very conspicuous; in another cluster close by were from six to eight *Ixias marianne.*

It will perhaps give some idea of the numbers when I say that

• I quite easily netted five *C. paulina* in one swoop, and seven in another.

Then *Hebomoia glaucippe* came along, reconnoitred the position with great circumspection, and settled warily for a second or two, but darted swiftly off at the least movement on my part. Nevertheless, with care and patience, I managed to secure a couple of specimens. My old friend *Papilio demoleus* came next and soon settled down a short distance away from the Whites; he was shortly followed by another of his own kind, and yet another: they all settled close together, within a hand's-breadth, forming an exclusive community, and continued to drink steadily. All at once a blue-green flash, and *Papilio telephus* sailed close past me; again and again he came, and finally, looking askance at the vulgar assemblage of Whites and Orange-tips, settled quite close to the *P. demoleus*, evidently preferring their more select company. This occurred several times. *P. telephus*, when settled with wings erect, displayed an unexpected beauty, for, in place of the ebony and emeralds on the upper-surface, it showed beneath nothing but sheeny mother-of-pearl picked out with tiny rubies. By patient watching and judicious swooping I secured three specimens, and, be it recorded, these were all I saw that day. So much for water; what share the decoys had in my success it is hard to say, but Mr. E. E. Green, of Peradeniya, told me that decoys were efficacious, and Mr. Denton, of Regent Street, says that he has used even paper decoys with success.

The congregation of butterflies at damp sand was observed by Bates on the banks of the Amazon in 1849. He noted that they were all males, mostly of the genus *Callidryas*.[1] Indeed Sir J. D. Hooker had the year before noted butterflies sitting on damp sand "in thousands" in the Ranjit valley, Sikkim.[2]

Mr. E. André noted a similar thing in Venezuela in 1897, where the attraction was the foul mud of a farmyard: the butterflies were chiefly *Callidryas*, with some *Heliconius, Papilio, Metamorpha* and *Caerois*. He adds: "Each species tried to herd with its own kind," but he says nothing as to sexes. There is a capital photograph in his book of a group of *Callidryas*.[3]

Doubtless this habit of butterflies is well known to all tropical collectors. I had myself in Germany, some thirty-four years before, noted swarms of Blues drinking at small puddles in the road—several species together.[4] At Mortehoe, on the 1st of August, 1905,

[1] "Naturalist on the Amazons," 1st edn., p. 249.
[2] "Himalayan Journals," Vol. I., p. 152 (1854).
[3] "Naturalist in the Guianas," p. 142. [4] See p. 25, *supra*.

in the early afternoon, I saw fourteen or fifteen *Ganoris napi* sitting close together on wet mud; they were all males.

Adjoining the plantation of the singularly graceful *Areca* palms was a piece of waste ground covered with *Lantana* in full bloom, this was crowded with butterflies such as *Crastia core* and *Narmada coreoides*, Moore, one or both of which (for I did not distinguish them when alive) was abundant; with them were several *Neptis eurynome*, and two or three *Nepheronia ceylanica*, Feld., another southern species. But more striking than all these were the swarms of *Tirumala limniace*, a big and handsome black and bluish-white Danaine, which I found all over India but never saw elsewhere in anything like such numbers as on that mass of *Lantana*.

Other things that turned up in the course of the two days' collecting were *Tachyris hippo*, two; *Teracolus etrida*, one; *Hypolimnas bolina*, two males; *H. misippus*, one male; *Precis iphita*, common; *Castalius rosimon*, Fabr., plenty of *Lampides celeno*, including the form *conferanda*; and one *Parnara mathias*.

A specimen of the fine Skipper, *Caprona ransonnettii*, Feld., was seen to settle, in full sunshine, on the *under-side* of a leaf, with its wings fully expanded like a Geometer. I do not ever remember seeing a butterfly do this before, but then we are perhaps wrong in calling Skippers butterflies. One of the *Lampides*, a female (?), was found settled close to the ground, with all its wings erect as usual and close together; it was, however, moving its hind-wings alternately, in a rhythmical manner, *in the plane of the wing*, about 10–15° forward and then back. No other specimen of the species was near it.

On the occasion of my first visit to Kallár, as we were walking back to the station, Solomon suddenly darted off like the wind, and I found that he was after a very large *Papilio* which he had caught sight of flying about a puddle in the road, some hundred and fifty yards off. He waited long and patiently until it settled to drink and then popped his net over it. It was a male *Papilio polymnestor* in splendid condition, familiarly called by Solomon a Blue-bottle. This haughty beauty was not kind to me at Kallár; many a time I caught a glimpse of her flying about in a supercilious sort of way, but she never gave me a chance of closer acquaintance. Solomon had the advantage of me in many ways, first and foremost in years, next in his keen sight, but he was also wily and skilful with his net. During the day he took among other things a specimen of *Papilio agamemnon*, Linn., a fine black-and-green fellow that I too had seen; also one of that grand diamond-beetle-green butterfly *Papilio crino*, Fabr., which

*I missed the next day at *Lantana* flowers, as I believe, through sheer excitement.

TRICHINÁPALI, lat. 10° 50′ N., alt. *circa* 400 ft. or less.

March 4th and 5th, 1904.

The famous Rock is a mass of granite consisting of enormous blocks—perhaps 100 × 50 × 50 ft. The rocks of Southern India struck me as unusual in this respect—the fewness of the joints. Whether this be due to the absence of frost, or to the stability of the hills and absence of earth-movements, I cannot say.[1]

My collecting here was almost confined to the banks of an irrigation canal, where the genus *Papilio* was represented by *P. hector*, *P. pammon*, and *P. aristolochiae*, of each of which I saw several.

Danaida chrysippus was common; in the male of *Tirumala limniace* I detected a very faint scent, suggesting old cigar-boxes.

Catopsilia pyranthe was rather common, the specimen preserved was of the intermediate form; a scent was noted in the male, but it was not so strong as in some of the Bankápúr specimens. Of *Delias eucharis* I took two females, by far the less common sex, at all events in collections. Both sexes of *Huphina nerissa* occurred. *Terias hecabe* was abundant.

The most striking fact about the butterflies of Trichinápali was the predominance of the genus *Teracolus;* of these I met with three species: *T. eucharis*, Fabr., was in abundance, but my specimens comprise eight males to two females; of *T. etrida* I took two males; and I was greatly delighted to see here for the first time that truly exquisite little gem the crimson-tipped *T. danaë*, Fabr., which proved to be rather common, and two of each sex were secured. It is one of the most "elegant flies" that I have ever seen alive.

Precis orithyia was common, the specimens small and brilliant; *P. lemonias* was in larger numbers than I met with anywhere else, in fact quite abundant; *Ergolis ariadne* was common; I netted a pair of *Byblia ilithyia*, Drury, *in copulâ*, one was of the wet-season form, the other intermediate tending to wet. As usual *Telchinia violae* was common.

I took here one specimen of that beautiful Lycaenid with the under-side striped like a tiger, *Spindasis vulcanus*. This is one of the butterflies with an anal lobe to the hind-wings, but unfortunately there was no opportunity of observing it at rest. *Lampides celeno*

[1] Dr. John W. Evans tells me that in the tropics eruptive rocks weather by a process of scaling, by which concentric layers are split off.

was common; some smaller and dingier Blues were abundant: *Zizera otis*, var. *indica*, and *Chilades varunana*. I also took one specimen of a small bright golden Skipper, *Ampittia maro*, Fabr.

TANJÚR, lat. 10° 47′ N., alt. 350 ft. or less.

March 6th, 1904.

The predominant genus of the plains of Southern Madras would appear to be *Teracolus*, which was represented in my envelopes from TANJÚR by a male *T. etrida*, a pair of *T. eucharis*, as well as five males and two females of my favourite Crimson-tip, *T. danaë*, which was quite common.

Of *Catopsilia pyranthe* I took a dwarf male of the intermediate form. *Terias hecabe* was common, and I took a very large female, over 1·8 inches in expanse, of the dry-season form. Single specimens of the following were sent home: *Nychitona xiphia*; *Papilio pammon*, male; *Danaida chrysippus*, female; *Castalius rosimon* and *Lampides celeno*, of the form *conferanda*. *Telchinia violae* was common, one being of a fine red colour.

MÁDURA, lat. 9° 55′ N., alt. 600 ft.

March 7th, 1904.

The imposing Dravidian architecture of the South culminates in the truly magnificent temple at MÁDURA. The traveller who confines his attention to the Northern cities will come away with the idea that *the* architecture of India is that associated with Islam. Indeed the sole Hindu religious work of the North which really impressed me was the colossal sitting statue of Siva in the celebrated cave on the island of Elephanta, near Bombay. That figure, with its three faces representing the god in his three aspects of creator, preserver, and destroyer, did to my mind suggest something super-human. All other sculptures that I had seen were rude, coarse, even repulsive.

The ancient Hindu temples of the North were destroyed by the Moslem invaders and the materials, as at Lálkót and Ajmir, used in the construction of mosques. Here, however, in the extreme south of the continent, stands a group of temples that for impressiveness recall those of Egypt. They are, however, much less ancient, having been for the most part erected between the 13th and 18th centuries.

In the great temple near Trichinápali it was interesting to see "the tables of the money changers, and the seats of them that sold

"doves," doubtless pretty much the same as those that stood in another temple nearly nineteen centuries ago.

Mádura was about the least productive place that I visited. *Danaida chrysippus* was scarcely common. A male *Huphina nerissa* gave out the sweet-briar scent quite strongly. I saw several *Telchinia violae* upon a railway bank. *Precis oenone* was fairly common; on the other hand *P. almana* was commoner here, about the irrigation ditches bordering meadows, than at any place I visited; they were of the "intermediate dry" form. *P. lemonias* was also abundant, some of them being very brightly coloured.

In a grove of young palms near the river a singular dragon-fly, *Rhyothemis variegata*, Linn., was tolerably common; the tips of its wings are transparent and colourless, but the basal three-fifths of the fore-wings, and the basal five-sixths of the hind-wings, are light-brown with a bold dark-brown pattern somewhat suggestive of tortoise-shell. I saw what was probably the same creature in the Kudsia Gardens at Delhi, flying near the tops of trees, and then, as now, took it for a *Heliconius*-like butterfly, which it somewhat resembles on the wing. Not knowing that any butterfly of that shape was found in India I was greatly excited at seeing it, and proportionately disappointed when at last its capture was effected.[1]

Mádura was the last place in India at which I collected.

On the voyage from Tuticorin to Colombo I met the wife of a missionary from Travancore. She had assisted her husband by working in the zenanas, and two results of her experiences greatly interested me. Strongly prejudiced as she was against the whole system, she told us that it had been a great surprise to her to find "so much beautiful family life within the zenana." It had been another surprise to discover that the women had such great influence on the conduct of public affairs.

This last fact seemed to offer some explanation of the existence of such a capable woman-ruler as the Begúm of Bhopál, and of such a heroine as the Máharání of Jhánsi, who was cut down by one of our men when charging at the head of her troops in 1858.

[1] Compare Prof. R. C. Punnett's experience, "Spolia Zeylanica," Vol. VII., Part XXV., p. 22 (1910).

CEYLON.

Lat. 7° N.

All the places that I visited in this beautiful island were within twenty miles north or south of the seventh parallel of latitude. The luxuriance of the vegetation was an immense relief after the parched plains of India. At the lower elevations it was more distinctly tropical than anything that I had yet seen, but this character was lost at greater altitudes. On the beautiful journey up from Colombo, we saw a magnificent specimen of the great Talipot Palm (*Corypha umbraculifera*, Linn.) in full flower, it is one of the glories of Ceylon.

PERADENIYA, alt. *circa* 1200 ft.

March 10th, 1904.

The justly celebrated gardens lie about four miles south of Kandy near the centre of the island. Their situation, in a bend of the river, is beautiful, and all our familiar hot-house plants grow luxuriantly in the open air:—splendid Palms of many kinds, some planted in solemn avenues, huge Bamboos almost as tall, various species of *Dracaena, Croton, Acalypha, Maranta;* Nutmeg, Cinnamon, Camphor; huge trees of *Ficus elastica* with roots spreading far over the surface of the ground. Grass has been largely ousted by the Sensitive-plant, *Mimosa pudica*, which, introduced from South America, has run wild it grows about a foot and half high, and when one walks through it a broad path is left owing to the collapse of the leaves. One of the most strikingly beautiful things in the gardens is the Giant Bamboo from Malaya, *Dendrocalamus giganteus*, growing in clumps 100 ft. in height, which bend gracefully over the waters of the Mahaweli-ganga.

Here, well out of reach, I saw my first *Ornithoptera;* truly it is well named![1] A second specimen came down to earth, but I missed it through sheer excitement. Several *Catopsilia pomona* were netted; one was a female verging on the *catilla* form, the others were typical males, one of which had a slight scent. Of three male *Terias hecabe* two were wet-season, the other of "intermediate wet" form. A male *T. libythea* was also of wet-season type, a female was also taken. The only Nymphalids noted were two *Neptis eurynome* and several *Precis iphita*. Here also I took my first *Parantica aglea*, Cram. (*ceylanica*, Feld.), a Danaine found in abundance later.

[1] The name *Troides* has priority.

Of *Orsotriaena mandata*, Moore, I saw only one, but the pretty little *Ypthima ceylonica* was swarming amongst the sensitive-plants. Mr. E. E. Green, the entomologist to the Ceylon Government, suggested that its colouring might be indirectly protective, since on the wing it looks much smaller than it is, only the white posterior two-thirds of the hind-wings being conspicuous, and these the least vitally important to the insect. The only Blue seen was *Zizera karsandra*.

A second visit to the gardens, rather late one afternoon, produced no insects, but gave me my only sight of a wild Cobra (*Naia tripudians*), about 2½ feet long, with a very large hood. I found myself for the first time in the near presence of a dangerously poisonous serpent without any plate-glass intervening. For a moment there was a struggle between the impulse to compass its destruction, and the fear of breaking my net stick in the endeavour, meanwhile the laidly beast crawled quickly away into the roots of a so-called Travellers' Palm, *Urania speciosa*, and I saw it no more.

Unfortunately for me, Mr. Green was on the point of going to England on leave, but though busy with his preparations for departure, he was good enough to show me several very interesting things, such as young snakes, larvae of the leaf-insect, etc.; above all he gave me some very useful advice. Peradeniya, he said, was not as rich a locality as Kandy; and, as regarded the highlands of Ceylon, he told me that, at any rate at that time of the year, Lepidoptera were for the most part confined to certain favoured spots, which it was unlikely that I should hit upon. He therefore strongly recommended me to concentrate my attention on Lady Horton's Drive at Kandy, advice that proved to be sound.

Kandy, alt. 1500 ft.

March 11th—15th, 1904.

On the eastern side of the artificial lake at Kandy stand some low hills, covered for the most part with natural forests, through which have been cut a number of roads named after the wives of former governors. Lady Horton's Drive is one of these, it runs about half-way up the hill, winding around its southern and eastern slopes. A wide road, bounded on either side with forest of rich and varied tropical growth, lying fully open to the morning sun, commanding, moreover, a glorious view over groves of palms to the bluest of distant hills, it affords an almost ideal collecting-ground. The climate of Kandy, so far as I experienced it, is delightful; tropical heat tempered by elevation, and with a pleasant softness in the air,

yet free from the excessive damp of many places within the tropics.* Its vegetation is by far the richest that I had seen. My pleasure in collecting in this earthly paradise was enhanced by the companionship of Mr. W. G. Freedley, junr., of Philadelphia, who had been collecting butterflies in Borneo, Celebes, Japan, Macao, etc.

In such a locality it was perhaps to be expected that Pierines would not be dominant, at any rate so it was. By far the commonest of the family was *Catopsilia pomona*, of which the males were very abundant, but strong fliers and by no means easy to catch. We remarked that usually they all flew in the same direction, and that uphill. As the females were comparatively scarce one was not surprised to see more than once signs of jealousy on the part of the males. On stroking the "scent tufts" on the hind-wings of the male, I detected a slight jasmine-like scent. A female *Terias hecabe* had apparently been bitten in both hind-wings when at rest, the injuries being more or less symmetrical. *Delias eucharis* was scarce, *Catophaga paulina* more common. In one case I saw a bird try to catch a specimen of the latter on the wing; the bird missed its quarry, but I was more successful; it proved to be a male.

The Danaines were well to the front, the commonest species being *Parantica aglea;* this is smaller and greyer than *Tirumala limniace* and varies considerably in size, a small male measuring only 2·5 in., a large female as much as 3·4 in. across the wings. It was curious that this species appeared in abundance late in the afternoons, as other things were retiring. I was surprised to find that a male when fluttering in the net gave out a strong scent like that of *Crastia core, i.e.* resembling acetylene. This was noted in two or three specimens, and was quite unmistakable. *Tirumala septentrionis*, Butl., appeared to be rather common; a female has the hind-wings much broken, perhaps from the bite of a lizard, but the breakage is only in part symmetrical. *Danaida plexippus*, of which I took a very small one, was very scarce, and I did not see *D. chrysippus* at all. The genus *Crastia* was represented by many individuals. I took five *C. asela*, Moore; of one of them I noted at the time, "has a scent as in *core*."

But the most prominent group of butterflies at Kandy was assuredly the Papilioninae; I met with six species. The most remarkable was *Ornithoptera darsius*, Gray, which is peculiar to Ceylon, an insect that I had greatly wanted to take; it appears to be fairly common, as two were seen at Peradeniya, seven or eight at Kandy, and two at Haragáma. It sails about somewhat slowly and

majestically, looking very distinguished in its rich yellow and black livery, and very impressive by its size, five and a half to six inches in expanse of wings! When it comes within reach it is not hard to catch, and I secured two males and a female, but it is a formidable-looking creature in the net, with a thorax suggestive of a Bombyx. Mr. Freedley told me that the males have a scent like sassafras, but I learned this too late for confirmation. The male *Papilio pammon* was common enough, one specimen was unusually small, measuring under three inches. Two specimens of *P. aristolochiae* (a distasteful butterfly) were brought home; one of them has the tips of the hind-wings up to the tails bitten off quite symmetrically, thus much resembling the mutilated specimen of *P. hector* taken at Kallár. Of the tailless *P. dissimilis*, Linn., I took three, but probably saw more, since it so very closely mimics *Tirumala limniace* or a large *Parantica aglea*, as readily to pass for one of those insects; it is indeed most easily distinguished from them by its habit of fluttering while feeding on a flower. One of my specimens has the anal angle and a great portion of both hind-wings bitten off in an almost symmetrical manner, suggesting the bite of a lizard. Prof. E. B. Poulton, in the paper alluded to above (p. 44), noted that whatever the cause may be, it is in the great majority of cases the *hind-wings* that suffer these injuries; doubtless the framework of the fore-wings is the stronger, but that does not seem to be a sufficient explanation, since owing to their greater length they must be more exposed to chance injuries from thorns and the like. One is therefore driven to the explanation that their enemies must usually attack butterflies from behind. Mr. Freedley took a *Papilio dissimilis* that mimicked *Euploea*, for the species is dimorphic, one form mimicking each Danaine genus. Indeed it would appear that the name *dissimilis* implies that its bearer is like anything rather than a *Papilio*.[1]

In a shaded glen down which a tiny stream and a footpath strove for the possession of the ground, I took close to the water a faded specimen of my Kallár acquaintance *Papilio telephus*, and missed another that was drinking at the mud. But far more exciting than all the before-mentioned species was *Papilio parinda*, a truly magnificent fly that dashed about in all directions.[2] It measures

[1] The nomenclature of this butterfly is very puzzling. Of Linnaeus' two names *clytia* and *dissimilis*, it would appear that the former has priority; *lankeswara*, Moore, is a Ceylon race of the dark form. My dark specimens might therefore be called *P. clytia lankeswara*, my light specimens *P. clytia dissimilis*.

[2] The male of the Ceylon butterfly is almost identical with that of the mainland; the female is distinct. Mr. Rothschild considers *parinda*, Moore, to be a local race

about 5½ inches across the wings and is rendered most conspicuous by its colouring—French grey and black. It rarely settled and was very hard to catch; Mr. Freedley and I were constantly striking at it, but it almost always eluded us. After many fruitless attempts I succeeded in netting two, one so battered that its powers of flight were seriously impaired; Mr. Freedley was even less fortunate, probably because he had a very small net.

There was yet another *Papilio* which eluded me altogether. It was black-and-green, and I feel pretty sure *P. agamemnon*, a butterfly that I missed at Kallár in the Nilgiris. It had the extraordinary and most aggravating habit of flying up and down, or rather backwards and forwards, just like a sentry, over some small trees below the road. Its path, if one may so call it, was about a dozen yards in length, and it always turned round at the same place, moving by a succession of jerks. I once actually watched it for twenty minutes so occupied, it then settled for a moment on a *Lantana* flower; I struck at it and missed, and the performance began again. Another day it was at its post as before. Of all the Papilios that I saw this species was by far the wariest.

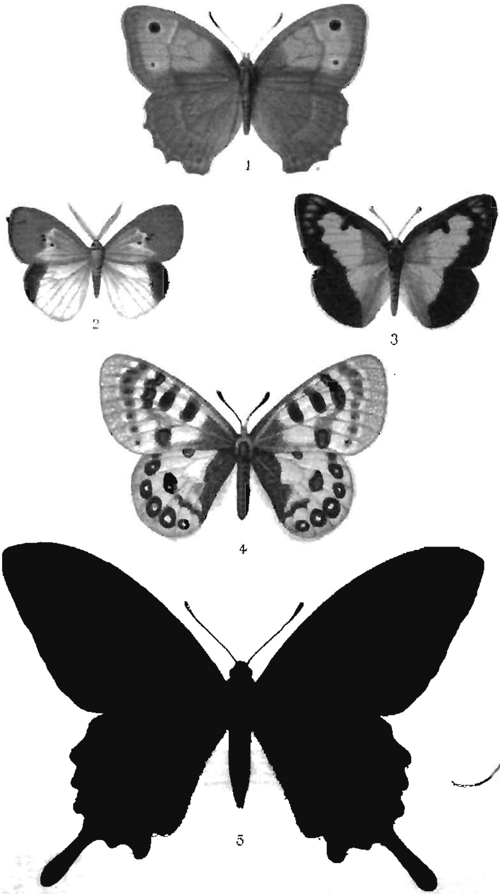
In striking contrast to the Papilios in every way are the Satyrines. A solitary *Mycalesis perseus* was a very unattractive shade-lover. The bright little *Yphthima ceylonica* was abundant; so far as observed it sits upright. *Nissanga patnia*, Moore, a very distinct species, with leaden metallic lines on the under-surface, was fairly common at the edges of woods, but I did *not* meet with it on the "patnas" or grassy plains of the highlands of Ceylon.

The Nymphalines met with included several interesting species, notably *Cynthia asela*, Moore, of which I saw a very fine example, but caught only a very tattered fellow. It seems to like sailing about over the trees. With *Cethosia nietneri*, Feld., I had similar ill-luck. Of *Cupha placida*, Moore, again I have but a very worn specimen annotated thus: "Has the swift flight and to some extent the habits of *Precis*, but is fond of resting on the leaves of trees." These remarks are probably intended for, or at least include, the allied *Cirrhochroa cognata*, Moore, which was certainly common, though very local; one of my five specimens, otherwise in good condition, has *two* snips taken out of each hind-wing, symmetrically, but it appears to be an insect readily chipped. Both these species have fulvous wings with black tips, so they are readily confounded in the field.

of *polymnestor*, Cram.; the late Col. Bingham suggested that *parinda* might be looked upon as a dimorphic female of *polymnestor* peculiar to Ceylon.

Plate I.

ASIA.



H. and Edgar S. Knight del. West, Newman Chromo.

1. EPINEPHELE DAVENDRA.
2. PANTANA AROA.
3. TERACOLUS PROTRACTUS.
4. PARNASSIUS HARDWICKII.
5. PAPILIO MAACKI.

Neptis eurynome might be said to have been abundant, while its ally, the brown-and-black *Rahinda sinuata*, Moore, was decidedly common. Of the Erycinid *Libythea rama*, which appears to mimic *Rahinda*, I secured one specimen at Kandy, and believe that I missed another in the Pashók tea-garden near Darjiling.

I saw no females of *Hypolimnas bolina* at Kandy, but took three males, one of which had lost both the anal angles of the hind-wings, the injury being in part symmetrical. *Precis iphita* was common, so was *P. atlites*, looking on the wing like a dingy *Neptis*; a new brood appeared on March 14th. *Ergolis merione* was common.

The Lycaenids were not well represented, but I saw several *Loxura atymnus*, Cram, var. *arcuata*, Moore; as usual *Lampides celeno* was common, almost spangling in the sunlight, among them was a single specimen of the yet more beautiful *L. lacteata*, de Nicév. (*pseudelpis*, Moore, *nec* Butl.). It is a somewhat rare butterfly reminding me of the British *adonis* (*bellargus*). *Talicada nyseus* and the dingy *Spalgis epius*, Westw., brought up the rear.

The Skippers were represented by single examples of the dull *Parnara mathias*, and the dark fulvous *Iambrix salsala*, Moore.

At rest on a fence outside the "Queen's Bath" I found one morning a fine Sphinx, *Meganotum melanomera*, Butl. A very distinct-looking Arctiid, having a crimson body and light pink fore-wings, with a longitudinal fuscous streak, *Creatonotus interruptus*, Linn., came to light, as also did *Eupterote diffusa*, Walk.

A few insects of other orders forced themselves upon me, busily occupied as I was, *e.g.* a gigantic, black female Carpenter-bee, *Xylocopa tenuiscapa*, Westw., with peacock-green wings; a very large, evil-smelling, brown Bug, *Tessaratoma javanica*, Thunb., covered beneath with a waxy substance that during life glistened like silver. Another bug, *Chrysocoris stockerus*, Linn., was an intense metallic green with black spots; yet more conspicuous than any of these was the large Fulgorid *Hotinus maculatus*, Oliv., a so-called Lantern-fly, expanding three inches across the wings. Its fore-wings are black and white, the hind-wings light blue with a very broad black border. This was fairly common, flying high and settling on tree-trunks out of reach, but easily disturbed, when it flies off to a similar resting-place not many yards away.

HARAGÁMA, 11 miles S.E. of Kandy.

March 12th, 1904.

This appears to be locally recognized as a great place for butterflies; the collecting-ground is along the course of a rapidly-flowing stream with wooded banks, perhaps 500 ft. below Kandy, or say 1000 ft. above sea-level.

Again I had the advantage of Mr. Freedley's company on the occasion of my expedition. The first thing to catch our attention was *Hebomoia glaucippe*, careering about in considerable numbers, but most unwilling to be caught.

The pretty little *Talicada nyseus* was literally swarming. Indeed I cannot remember ever having seen a Lycaenid in such numbers. It was repeatedly observed to settle with its head upwards and immediately turn round. This habit of resting with the head down is common, if not general, in the family, and has an obvious bearing on the protective use of tails, anal lobes, and directive marks.[1] *Zizera otis* was also in abundance, and *Lampides celeno* was common.

Tirumala septentrionis was not common, and the specimens netted were tattered males; one had a symmetrical injury near the anal angle of the hind-wings, possibly due to the bite of a bird. I saw a few specimens of *Crastia asela*, and secured two males, which exhibited the acetylene odour.

Neptis eurynome was common, and I took a specimen of the elegant Hypsid day-flying moth *Deilemera nigrovenosa*, Moore, which seems to mimic it. Of the beautiful *Nepheronia ceylanica*, I took one male. *Cirrhochroa cognata* was noted flying about a particular tree and did not appear to be attracted by flowers; I only saw it in that one spot, and the two taken were in poor condition. It is very like *Cupha placida* (*Messaras erymanthis*, Stgr.), of which I took a fine specimen close by, at wet sand. I again confounded the two species as at Lady Horton's Drive. A few *Ergolis ariadne* and several *Nychitona xiphia* were seen. A male *Huphina nerissa* had the sweet-briar scent; a female was in fine condition.

At the furthest point reached in our walk, by a little bridge, two or three spots in the damp sand appeared to be very attractive. Besides the *Cupha* already mentioned there was *Ixias pyrene*, var. *cingalensis*, and *Papilio pammon*, the male, which was also seen flying about bushes, but not at flowers, was rather common. My Kallár friend *Catophaga paulina* was literally in crowds; they were all apparently males, sitting in dense clusters, their pointed white wings

[1] See Chap. X. § 10.

suggesting to me toy encampments. I easily netted ten at one swoop, while Mr. Freedley by a more cunning movement succeeded in getting as many as thirty-four into his net! In the same place I saw six or seven of the beautiful *Papilio telephus*, settled quite close together, and managed to secure three of them. It is a black-and-green species not easy to distinguish from *P. jason*, Linn.

The females of *Catophaga paulina* were common at flowers. One of the males, by the way, had a symmetrical injury to the *tips* of the hind-wings, but I can hardly see how it could have been inflicted by an enemy without simultaneous injury to the fore-wings.

This day I saw two *Ornithoptera darsius*, one quite out of reach, the other I missed badly.

Hatton, alt. 4200 ft.

March 16th—18th, 1904.

In going up-country from Kandy, when near Ullapáne station [alt. *circa* 2500 ft.] I caught, from the train, *Narmada montana*, and a little further on, *circa* 3000 ft., a male *Catophaga paulina*, a species that is very abundant in the Ceylon highlands.

Before Hatton is reached the line enters the tea country, whence the glorious primaeval forests have disappeared, having been ruthlessly and completely cleared out to make way first for coffee and later for tea. Though doubtless "grateful and comforting," the tea-plant is most unpicturesque, only by a little surpassing the potato in that quality. The Australian *Grevillea* trees [Nat. Ord. *Proteaceae*] with their light feathery foliage, planted in regular rows to shelter slightly the tea from sun and wind, do but little to relieve its stiffness, and are a miserable substitute for the departed woodland glories, indeed they almost deserve to be classed as "undesirable aliens." About Hatton there are but scraps of the forest left on the tops of the highest hills, and we were told that the tea-planters are constantly urging the Forest Department to allow these to be improved away.

Here for the first time I examined *Catophaga paulina* for scent, and was surprised to find that the three males tested had a scent nearly as strong as that of *G. napi*, but different; it was described at the time as "like sweet-briar, but sweeter and more luscious," and I wrote to Dr. Dixey the same evening, adding that I had no doubt whatever.

About the hotel garden *Argynnis hyperbius* was common; a male had the fore-wings notably shorter and broader than usual.

A stroll in what is left of the old forest, towards the top of

a high hill, say at about 4500 ft., produced several specimens of *Lethe daretis*, Hew., a regular sylvan Satyrine, repeatedly settling on the path, apparently always erect. Two of them had lost large portions of the hind-wings near the anal angle, one symmetrically and in a way to suggest the bite of a lizard. On the under-surface of this butterfly the unusually large light-coloured scales set on a black ground near the hind margin of the hind-wings are strikingly conspicuous. In the same scrap of forest I took a single specimen of another species of the same genus, *L. drypetes*, Hew. (*embolina*, Butl.); also a *Limenitis calidasa*, Moore, settled on a leaf of a tree far from the ground, as is usual with the genus. Several *Atella phalantha*, a few *Neptis eurynome* and *Terias hecabe* were also seen, a female of the last-named being of the "completely wet" form.

My only specimen of *Cyaniris singalensis* is very like our *argiolus*. With some difficulty I secured a specimen of the large black and white Skipper, *Celaenorrhinus spilothyrus*, Feld. This was the second Skipper [the other being *Caprona ransonnettii*, at Kallár] that I had seen settle on the *under-side* of a leaf during *full sunshine*, the wings being expanded like a Geometer's. Another example was settled on a rock with its wings expanded in like manner.

In the hotel I found at rest on a wall what at the time I took to be a fine Burnet, but it was the Syntomid, *Euchromia polymena*, Linn.,[1] it has narrow black wings bearing orange spots, the body is blue, ringed and collared with scarlet; in my bedroom I took a beautiful little Tortrix-like Noctua, *Metachrostis incondita*, Butl., measuring only 17 mm. across the wings: also *Pomasia psylaria*, Guen., a pretty little yellow Geometer with metallic markings, evidently attracted by light; with the moths was a most formidable-looking, long-waisted wasp, *Eumenes petiolata*, Fabr., a female.

We visited Hatton in order to ascend Adam's Peak, driving thence to a small hotel near the mountain. We were called at midnight, and started soon after by the dim light of lanterns. The last 1000 ft. or more is a remarkably steep cone of granite, sparsely covered with scrub. The ascent presents no mountaineering difficulties, but is remarkably fatiguing as it consists of excessively irregular steps, some natural, others hewn out of the rock, or built up, some formed by roots. It took nearly two hours, and to go up steps continuously for that length of time by lantern light, with eyes glued to the ground, is trying alike to eyes and limbs, nerves and

[1] The Syntomids have for the most part a strong resemblance to the Zygaenids, and Sir George F. Hampson, in his "Moths of India," placed the two families next to one another, but he has more recently separated them widely.

temper. So steep is it that the descent took nearly as long as the ascent. There is another way up, on the other side, where it is said the pilgrims help themselves up the worst parts by very ancient chains. On the summit, 7252 ft., live the priests who show pilgrims the Footmark, said by the Buddhists to be that of Buddha, by the Hindus that of Vishnu, by the Mohammedans that of Adam, and by the native Christians that of St. Thomas. Under all the circumstances it is scarcely surprising that the footmark is nearly six feet long!

Having visited Gaya where Gautama meditated under the Bo-tree, Sarnáth where he first taught, the Temple of the Tooth at Kandy, and finally having made the great pilgrimage to the top of the Peak, we all felt that we had "acquired much merit."

When coming down from Adam's Peak on March 18th, at the height of about 6000 ft., I saw several of the Lithosiid, *Asura uniformis*, Hmpsn., but in the rough scramble of the descent could only secure one; at about 4800 ft. were several *Talicada nyseus*, and a few hundred feet lower down I bottled two green beetles, *Coryphocera elegans*, Fabr., somewhat resembling our Rose-beetles, but much more shiny.

NUWÁRA ELIYA, alt. 6200 ft.

March 18th—21st, 1904.

This Sanatarium is like Útakamund in that it is situated on a grassy plateau forming a basin among mountains. The "patnas," or grassy areas, are bounded by woods, which in their turn are fringed by somewhat stunted scarlet Rhododendrons. At the best season it doubtless affords excellent collecting, but I found Mr. Green's statement, that I should be unlikely to light upon the good localities, amply confirmed.

I saw several *Papilio teredon* flying about, and secured two that were drinking at wet mud. A female *Terias hecabe* proved to be of the wet-season form. Of *Neptis eurynome* I took two. In a sedgy place I took the Skipper *Baracus vittatus*, Feld., curiously enough the only butterfly that I had taken in a swamp up to that date. The streaky markings of the under-side, following the veins, appeared when the insect was settled on sedge to be strongly protective. Of *Talicada nyseus* I saw several; the only other Blue seen was the *argiolus*-like *Cyaniris lanka*, Moore, much battered.

Among moths I found one of the yellow Geometer *Corymica specularia*, Moore, at rest on a tree-trunk, and an Acidaliid, *Idaea costata*, Moore. Also on Mt. Pederutalagalla, at about 8000 ft., the

Skipper *Baracus vittatus*, again among sedgy grass, and *Abraxas sordida*, Hmpsn., flying at dusk. This last, a nearly uniformly dark fuscous insect, is presumably scarce, since the British Museum possesses the type only.

Hakgála, alt. 4800 ft.

On March 19th and 21st I visited the beautifully situated and well-kept Botanical Garden at Hakgála, some five miles south of Nuwára Eliya and at a considerably lower elevation. Nestling under beetling crags, which form a grand background, it is a glorious blaze of flowers.

Along the road *Catophaga paulina* was swarming, males with their sweet-briar-like scent appeared to predominate largely. They flew rapidly and always in the same direction—roughly speaking, from south-east to north-west. They frequently flew in strings, just as if they were tied together, and reminded me strongly of the strings of floating stars that are dropped by a certain kind of rocket; I often saw three, four, or five, and once even seven, so following their leader's every movement.

At a turn of the road close by the garden there was a small patch of a tall, but small-flowered Composite plant (*Vernonia* sp.); this plant did not appear to be common in the district, but it was especially attractive to a black Danaine, which was quite abundant within the limits of the plant's distribution. *Chittira fumata*, Butl. (peculiar to Ceylon), is very distinct and handsome on the wing, its flight is slow and it is easy to catch, but like all Danaines it has a tough integument and is very tenacious of life. The favoured flower was so attractive to the butterfly that it would even go into deep shade to visit it. *Chittira fumata* may be said to be gregarious; it has the acetylene odour of *Crastia core*, but not so strong and with a difference. I made no observation as to the relation of scent to sex in this species, which, by the way, was almost certainly seen at Hatton.

Near this same spot I took one *Tirumala septentrionis* as well as two *Crastia asela*, and saw others.

The inevitable Lycaenids were worn *Talicada nyseus*; *Lampides bochus*, one; and *Polyommatus baeticus*, which was common.

It was interesting to watch the pretty little Honey-birds (*Dicaeum* sp.) feeding at some tall spikes of flowers.

HORTON PLAINS, alt. 7000 ft.

March 23rd, 1904.

This beautiful district gives some idea of what Ceylon must have been before the era of tea-planting. Situated about 2500 ft. above the railway, and approached by steep zigzag paths through rather poor woods, are extensive rolling plains of coarse grass; these patnas are surrounded by woods having a general temperate zone character, but with here and there an epiphytal orchid to remind one that the latitude is but 7° N. In the more swampy parts of the patnas the devastating work of Wild Pigs was evident enough; we also saw tracks of the so-called Elk, the Sambhur (*Cervus unicolor*), while paths through woods, and unmistakable droppings, proved that wild Elephants had passed that way not many days before. It was, however, not the season for Butterflies, the air being too exhilarating for their luxurious ways.

About half a dozen *Chittira fumata* were seen at elevations of 6000 to 7000 ft., mostly at their favourite *Vernonia*. On the patnas and among sedges in the woods were a few of the Skipper *Baracus vittatus;* they were not easy to see. I was surprised to come across no other butterflies on these patnas, which seemed the very place for a Marsh Fritillary, a Small Heath, or at least for a Blue; but no, even the eponymous *Nissanga patnia* was not to be found.

In the woods I took two specimens of the beautiful *Lethe daretis*, and saw two or three others. They frequented shady paths and flew but a short distance, settling upon a trunk or branch, reminding me strongly of *P. aegeria* in my own garden at Mortehoe. The only *Argynnis* seen here (or indeed in Ceylon) was *A. hyperbius;* it was rather common in open spots in woods, the female looking on the wing very like *Danaida chrysippus;* a female had the apices of both hind-wings and the anal angle of both fore-wings symmetrically bitten.

Of *Terias hecabe* I found in a wood a few of the intermediate "dry" form. *Neptis eurynome*[1] was not uncommon in the woods, flying in its usual ghostly manner, and settling upon leaves of trees. In the same woods *Cyaniris lanka* was common, but yet it was astonishing to see so few insects in such a locality.

[1] Col. Bingham, the latest authority, in his "Butterflies of British India," reckoned *astola*, *varmona*, and some others of Moore's species as mere forms of *eurynome*, Westw.

HAPUTÁLE, alt. 4500 ft.

March 23rd, 1904.

When we got back at night after our long day on the plains, we found two disconcerting things: my native servant was drunk, and a hen had laid an egg in my daughter's bed! The latter event was said to portend unusually good luck, but my daughter perversely viewed it otherwise.

At the beautifully situated Rest-house, overlooking the plain and the old camp of the Boer prisoners, a great many moths came to light. Prominent among these visitors, owing to its numbers, was the small Noctuid, *Plotheia decrescens* (*frontalis*), Walk., an extraordinarily variable species; another Noctuid was *Cosmophila xanthindyma*, Boisd.; there were two Deltoids, *Olybama lentalis*, Guen., and *Rivula basalis*, Hmpsn.; the Lymantriid *Dasychira inclusa*, Walk., and the extremely widely distributed *Plemyria* (*Camptogramma*) *fluviata*, Hübn., which I used to take at Wandsworth many years ago.

The formidable looking beetle, *Xylotrupes gideon*, Linn., was an uninvited visitor to my bath-room.

On the same day an Acidaliid, *Idaea costata*, flew into my face in a tunnel near Ohiya station, alt. 5000 ft. The railway journey back to Colombo is perhaps the most beautiful that it has been my lot to make.

COLOMBO, at sea-level.

March 25th and 26th, 1904.

Following Mr. Green's advice, I went to the Museum and was well rewarded, though too pressed for time to reap all that I might have gained by a more deliberate examination of the local collection of butterflies.

My collecting grounds at COLOMBO were the Victoria Park, much exposed to the sea-wind; the old Cinnamon Garden, said to be much worked for insects by the Museum "boys"; and the old Dutch Cemetery. None of these were very promising or very productive.

However, I saw here for the first time in Ceylon *Danaida chrysippus*; I also netted one *Parantica aglea*, and missed what I thought at the time was *Hestia jasonia*, Westw.

Precis atlites was common in the Dutch Cemetery, but worn, so was *P. almana*, nearly all of the wet-season form, *P. asterie*, Linn.; one specimen, however, was dwarfed, and another was of the "dry"

form with the ocelli rudimentary. *P. almana* would appear to be the more prevalent species in Ceylon and Southern India, where it replaces *P. orithyia*, so universal in the North.

I saw several *Delias eucharis* in the Victoria Park, and once more noticed their fondness for lofty flowering trees; those taken were males. In the same place, what I think must have been the *catilla* form of *Catopsilia pomona* eluded my net; its congener *pyranthe* was common, and I took two males. Once more *Telchinia violae* was common, but of *Papilio aristolochiae* I have only one to record, of *Yphthima ceylonica* two.

Of the Blues there were several species. *Nacaduba ardates* was very abundant and decidedly gregarious, it positively swarmed in Victoria Park, though good specimens were scarce. *Everes argiades*, Butl., var. *parrhasius*, Fabr., and *Zizera karsandra* were also both of them abundant. I took also a single worn specimen of *Castalius rosimon*.

An immature example of my Peshâwar friend *Tryxalis nasuta*, taken in Victoria Park, completes the list of my captures in Ceylon, an island that I was truly sorry to leave and that will always occupy a treasured place in my memory.

English is more spoken in Ceylon than in most parts of India, but the Sinhalese appear more noted for fluency than accuracy. The inner meaning of the following apparently strange request of a lad is easy to fathom: "Master, buy some butterflies, ready-made." On getting back to the hotel from an entomological expedition, one of the messengers came up to me and said: "Missie told you to told me they had gone in."

CHAPTER III

CHINA, JAPAN, CANADA, 1904

STRAITS SETTLEMENTS

PENANG, lat. 4° 22′ N.

Good Friday, April 1st, 1904.

AFTER a pleasant voyage across the Indian Ocean, affording the rare experience of a calm so absolute that the glassy sea reflected not only a brig with all sail set, but the clouds above it, the "Malta" called at Penang. In this island port, which owes its marvellous prosperity chiefly to tin, the Chinese are to be seen at their very best. The combination of a British Government with a population mainly Chinese would seem to be a conspicuous success. Whether it be as coolie, as merchant, or even as magistrate, John Chinaman prospers, ousting the native Malay.

It was early in the morning when we arrived, and our stay was very brief, merely giving time for a rapid run round the town. Though I caught sight of two large butterflies I made no attempt at pursuit.

We were struck with the artistic merit of the common saucers or bowls out of which, with the aid of chop-sticks, the dock-side coolies ate their frugal breakfast. The Herculean frames of the Chinese 'rikisha coolies were most impressive, especially their huge calves, contrasting with the familiar spindle-shanks of India. How much of Bible phraseology is simply Oriental, *e.g.* if the Psalmist had lived in a trowser-wearing land he never would have used the words, "Neither delighteth He in any man's legs"; again in showery Europe one scarcely sees the point of "shaking the dust from off one's feet."

Naturally enough the local cab-driver has little love for the 'rikisha coolie. A Jehu said to us deprecatingly, "'Rikisha man no savez; no speak English." It is perhaps as well to explain what Pidgin English is. It may be regarded as essentially Chinese translated directly into English: a few simple English words being strung

together with Chinese construction. The word "Pidgin," literally "bnsiness," has, in combination, come to mean pretty much what "ology" does in modern English.

A traveller on his return home told a friend that Pidgin English was a most flexible language, capable of expressing any idea however complex. His friend said, "I bet you it could not express the idea *Archbishop*."

"The simplest thing in the world," replied the traveller; "number-one topside Joss-pidgin man."

Joss being God, joss-pidgin is equivalent to Theology or Religion, and the sequence is obvious. Savez, now cosmopolitan, is possibly the only French word in the language. Neither Pidgin French nor Pidgin German is spoken in commercial circles.

SINGAPORE, lat. 1° 17′ N.

April 3rd, 1904.

As the "Malta" was slowly going to her berth in the inner harbour a vulgar "tramp" actually presumed to "take her water," so that to avoid a collision the proud P. & O. mail steamer was forced to port her helm and in so doing ran down an unfortunate coal lighter. This sank with a gurgle, its crew of two men climbed up our cable unhurt, while the proverbial rat was seen to rise in the patch of black scum which marked the position of the sunken craft, to look round, taking stock of the situation, and swim ashore. The captain's wrath at the disrespectful conduct of the pilot in charge of the trading steamer may be imagined.

We had on board a number of chests of new dollars from the mint, and a smart armed party of Sikh police marched up to take charge of the Government treasure. To avoid the horrors of coaling we went ashore and spent a very hot night at a crowded hotel, but the next morning managed to snatch an hour or two for a visit to the beautiful Botanical Gardens. It might have been expected that the great profusion of flowers would have attracted a proportionate crowd of butterflies, but gardens, especially when so well kept, afford but poor collecting grounds. Moreover, hot though it was, the sun was scarcely bright enough for my fastidious clients. Nevertheless to a naturalist visiting an Equatorial locality for the first time everything is of interest.

The commonest butterflies were *Precis atlites*, Johanss., and *P. almana*, Linn., but I did not waste much time in pursuit of them. The single *almana* brought away was of the "wet" form *asterie*, Linn.;

two *atlites* were a worn "wet," and a fine intermediate "dry" specimen. A female of the *crocale* form of *Catopsilia pomona*, Fabr., was secured. *Catochrysops pandava*, Horsf., the wet-season form, was in some numbers, as was also *Terias hecabe*, Linn., of which wide-ranging species two males and a female were taken, all of the wet-season form. All these were disappointingly familiar friends, but somewhat more striking (because new to me) were *Danais agleoides*, Feld., and *Danaida* (*Salatura*) *hegesippus*, Cram. Of the former I saw but one, of the latter several in the outskirts of the garden. Perhaps the most lovely sight in this lovely garden was a pond filled with the sacred Lotus (*Nelumbium speciosum*, Willd.) in full flower; but those of the party who were not on entomology intent were hard to please; they complained (most unreasonably as I thought) of the excessive heat, and were glad to leave a place but 77 miles north of the Equator.

Hongkong, lat. 22° 20′ N.

April 8th—19th, 1904.

Hongkong is well known to be one of the most frequented ports in the world, but surely it is more than this, it is one of the most beautiful. The blue water of its extensive harbour hemmed in by mountains and dotted with rocky islets affords anchorage to countless craft sailing under every flag and varying in build from the clumsy but picturesque junk, and the snake-like destroyer, to the latest type of ocean liner and most modern battle-ship—the whole forming a picture not easily erased from the memory. Among the larger craft are countless row-boats, or sampans, navigated by women, who often have a baby strapped upon their backs, an arrangement apparently equally agreeable to both parties. The city of Victoria is divided into a European and a native quarter. The latter, in spite of the buildings being in great part of European type, is quite picturesque, its streets going up and down steps like Clovelly.

The men's hats are at least as wide as their shoulders, nearly flat with pointed crowns; but porters, the Chinese police, and other minor officials wear hemispherical hats bearing an ideograph with an English number. The men all wear pigtails, women who pretend to be at all above the ruck go in for "golden lilies" and hobble about in the most pitiful way on their little stumps of feet, often helped by women of a lower class, but with more natural organs of locomotion. Bluejackets of several nations hugely enjoy 'rikisha riding. Soon after S.M.S. "Hansa" came into the port an

enterprising German bar-keeper hoisted a German flag, and in a very short time had nearly all her liberty-men drinking inside—like moths at sugar. But superior to every one in the middle of the crowded streets stands the Sikh policeman; very tall and proud, with tightly curled beard and big pagri of many colours, looking down with undisguised contempt upon the motley throng of all races and nationalities.

Hongkong is a strongly fortified naval station, and approach to the fortifications is guarded with commendable jealousy, but the military authorities are not consistently wise. For example, on a prominent building, which must be conspicuous alike from the harbour and from the sea outside, is written up in large letters, "Magazine Road." This unfortunate name quite gratuitously calls the attention of the passer-by, and doubtless of the foreign naval officer, to the well-hidden magazine not far off, to which this house can but serve as a leading mark. Again, on tho wall of a well-concealed modern battery, just below a public footpath, is written up the calibre and description of the armament, with its exact height above the sea—data which would have been equally available to the garrison if painted on the reverse wall of the battery, and so out of sight of the road.

Perched some 1200 ft. above the busy city of Victoria, and often enveloped in damp clouds, stands the Peak Hotel, which was our comfortable resting-place, memorable alike for its panoramic view over the harbour to the mountains beyond Kowloon, its excellent "bird's-nest soup," and the luxuriant growth of mould upon our boots and shoes. Even Devonshire had not prepared me for such dampness, indeed the drying-room was one of the most important and best managed departments of the hostel. Communication with the city was by a somewhat alarming funicular railway, which one is forced to use, for otherwise, as a 'rikisha coolie said to me with much truth, "Topside no can."

Convenient paths cut on the sides of the hill afford capital collecting ground, butterflies being most plentiful on the wooded slopes to the east of the city above the Happy Valley. Coming so recently from India, where the results of persistent drought were so painfully in evidence, it was a delightful relief to see the shrubs and trees all bursting into fresh spring verdure. The first plant to catch the eye was the small orange-red *Azalea* (?) *sinensis*, then in full bloom; it constantly reminded us that this was neither the coast of Cornwall, nor the Channel Islands, not even the Riviera di Ponente, nor the Bay of Naples. I was yet more pleased to happen upon

several tall spikes of the handsome ground-orchid, *Phaius grandifolius*, Lour., which I had long grown in my hot-house at Putney.[1]

Now for our butterflies. The only Danaines met with were *Radena similis*, Linn., of which one example was captured on a Composite flower, and the gorgeous purple-glossed Euploeine, *Trepsichrois midamus*, Linn. (*superba*, Herbst). This very striking insect was not uncommon at the flowers of *Lantana camara*, Linn., indeed what Oriental butterflies did before this Neotropical *Verbena* was introduced into the East I know not. Be that as it may, I secured two males and four females of *midamus*. As is so often the case with members of this group, this butterfly is hard to kill; again, when it is pinched, a yellow juice exudes, which appeared to have no marked taste, but one of the females had such a powerful acetylene-like odour as to be clearly perceptible when in the net.

The Satyrines were represented by *Lethe confusa*, Auriv., of which two were secured, two *Yphthimas*, and a *Mycalesis*. The latter, *M. mineus*, Cram., f. *chinensis*, Leech, was rather common; two of the specimens taken were "dry," three "intermediate tending to dry," and one "intermediate tending to wet." Of *Yphthima hübneri*, Kirby, which was quite common, four wet-season specimens were taken, two ♂, two ♀, also two ♂ that were "intermediate wet." Of *Y. avanta*, Moore, two "wet" examples were taken; it was only moderately common; specimens observed at rest did not exhibit the Satyrine habit of "listing."

A little below the Peak, near the funicular railway, I saw three or four *Clerome eumeus*, Drury—the only Morphine butterfly that I came across during my long journey—it appeared to be a somewhat solitary fly and rather fond of shade; somehow it was not easy to net and I secured only one specimen.

Curiously enough the only Nymphalines among my Hongkong captures are two *Cupha erymanthis*, Drury, and two species of *Neptis*, though it is possible I may have *seen* some *Precis*. Both *Neptis ophiana*, Moore, and *N. eurynome*, Westw. (but ? *leucothoë*, Cram.), were fairly common; of the first I brought home two, of the latter five specimens.

[1] In January, 1907, it was my singular good fortune to come across two plants of this same orchid in the Mahogany Wood, Rockalva estate, Ramble, Jamaica. This extraordinary instance of wide distribution excited the admiration of P. H. Gosse ["A Naturalist's Sojourn in Jamaica, 1851," p. 137, where the plant is given its synonym *P. tankervilliae*, Dryand.]. I have, however, been informed since by Mr. W. Fawcett that this plant was introduced into Jamaica about 120 years ago, and is now common all over the island. *See* Fawcett and Rendle, "Flora of Jamaica," Vol. I., pp. 108–109.

Five *Abisara echerius*, Stoll, and a single *Zemeros flegyas*, Cram., represent the *Erycinidae*; the former was locally common.

As a family the *Lycaenidae* were by no means numerous, though *Zizera argia*, Ménét., f. *similis*, Moore, was certainly abundant: it did not object to flying when the sun was obscured, or even when rain was falling. The other Blues were *Iraota timoleon*, Stoll, looking like large *Thecla quercus*, Linn., of which I took two; and *Lehera eryx*, Linn., a Hair-streak with a green underside like our *T. rubi*, Linn., of this I secured but a single worn specimen.

The Pierines appeared to be neither numerous nor remarkable. The Common White of the island was *Ganoris canidia*, Sparrm.; a ♂ yielded a most distinct scent of the sweet-briar type. *Huphina nerissa*, Fabr., f. *coronis*, Cram., was not common; the two taken, ♂ and ♀, were of the wet-season form. On the other hand, there were plenty of *Terias hecabe*, but the ♂ and two ♀ brought home were all "dry." I secured but a single example of *Catopsilia pyranthe*, Linn., a ♂ of the form *gnoma*, Fabr.; this yielded a distinct, but not strong, jasmine-like scent.

But if the Hongkong Pierines are insignificant the same complaint cannot be made of the Papilionines, which were very much in evidence, being both numerous and varied. Of the widely distributed *Papilio pammon*, Linn., which was common enough, I took two males. Of *P. helenus*, Linn., I got four specimens, one of them decidedly small; the creamy patch on the hind-wing of this butterfly is very conspicuous as it flies. Then again there was the handsome *P. paris*, Linn., swift and hard to catch; of the four specimens that I managed to secure one had large pieces (apparently) bitten out of all four wings almost symmetrically. Less common than the three preceding were *P. telephus*, Feld., and *P. bianor*, Cram., both taken at *Lantana* flowers, and lastly the handsome long-tailed yellow and black *P. antiphates*, Cram. (*alcibiades*, Fabr.), which, though not scarce, proved to be wary and hard to catch.

The Skippers were also represented by six species: the dingy *Parnara bromus*, Leech, three; *P. pellucidus*, Murray, four; *Iambrix salsala*, Moore, two; *Suastus gremius*, Fabr., one; the nearly black *Astictopterus henrici*, Holland, which was common; while of the bright tawny *Telicota augias*, Linn., I took two males.

One circumstance struck me as remarkable: in the "Happy Valley," beyond the cemetery, the ground was so fouled with human excrement as to make collecting difficult, yet clouds of butterflies (*Papilio*, of more than one species, *Trepsichrois*, and *Ganoris*) fluttered about the *Lantana* bushes growing around. There was no evidence

that the insects were attracted by the ordure, but of a certainty they were not repelled by its stench.[1] Yet experience of collecting in England (especially of sugaring) has convinced me that moths avoid the neighbourhood of dung-hills, ashpits, and refuse heaps.

Another circumstance worth noting is that close by the *Lantana* was a quantity of another Verbenaceous plant with blue flowers (probably a *Stachytarpheta*) which appeared to be scentless. This attracted swarms of the common *Ganoris*, but not a *Papilio* or *Trepsichrois;* perhaps the tube of this flower was too small for the proboscis of the larger butterflies.

Day-flying moths are quite a feature of Hongkong, and several notable sorts turned up. Of *Chalcosia thallo*, Linn., only one was taken, but of another moth belonging to the same group, the black and white, red-headed *Pidorus glaucopis*, Drury, I got six; a single individual of *Euschema* (*Dysphania*) *militaris*, Linn., a big gaudy slow-flying Geometer with black and yellow colouring, brought vividly to mind our own *Arctia villica*, though it is even more like the Chalcosiine *Canerkes euschemoides*, Moore. Another Geometer that made itself obvious was the large yellow and fuscous Magpie, *Obeidia tigrata*, Guen.; this has a somewhat slow flight, and on the wing often looks like a yellow butterfly; it was abundant and decidedly gregarious, many flying about one tree in the afternoon. When pinched it exudes a yellow juice having a bitter taste. I do not appear to have examined it for scent, but whether or no it possesses an evil odour, it has other characteristics of a protected species. At flowers I took single specimens of the fuscous and white *Leptosoma celsum*, Walk., and the orange-headed, black and white *Macrobrochis gigas*, Walk., both belonging to the *Hypsidae*. At flowers there was also a yellow-under-winged Agaristid, *Zalissa albifascia*, Walk. (var.).

Another day-flying moth belonging to quite a different group, the *Lymantriidae*, was a smoky-grey and white *Pantana* not represented in the British Museum. Mr. Druce told me that it agreed with a species described by him from a specimen taken on the Chinese mainland under the name of *eurygania*. I gave Sir George Hampson a specimen which stood in the collection at Cromwell Road for some time as *Pantana eurygania*, Druce. Subsequently, however, Col. C. Swinhoe examined it, and satisfied Sir George that it was distinct from Druce's species, and described it as *P. droa, sp. nov.*[2] I found the males flying freely among pine trees above the Happy Valley,

[1] See above, p. 89; compare *Trans. Ent. Soc. Lond.*, 1906, p. 315.

[2] *Ann. Mag. Nat. Hist.*, 7th Ser., vol. 17, p. 548 (1906). "Nearest to *P. terminata*, Walk., from Burma."

they did not seem to mind a certain amount of rain. It is surprising that so conspicuous an insect should not have been recorded before. (See Plate I., Fig. 2.)

At rest upon a rock, looking just like a piece of lichen, was the Lithosiid *Parasiccia punctatissima*, Pouj., while one afternoon I happened upon a fine freshly emerged specimen of *Actias selene*, Hübn., sitting on a plant; a day or two later another came to the hotel lights during dinner.

The handsome blue Cicada, *Geana maculata*, Fabr., was in abundance, flying slowly from tree to tree.

On some nights the gas-lamps outside the Peak Hotel proved very attractive. The Arctiids were represented by one *Utetheisa pulchella*, Linn., and two males of the very variable Ermine, *Diacrisia obliqua*, Walk.; the Lymantriids by one *Euproctis varians*, Walk., and a female *Aroa socrus*, Geyer (*substrigosa*, Walk.); the Limacods supplied a single *Thosea sinensis*, Walk.; there was also a solitary Nolid, *Celama pumila*, Snell. The Geometers on the other hand were somewhat more numerous, including *Craspedia propinquaria*, Leech, a small species resembling *Eois bisetata*, which came freely, and was also taken by day at rest on a leaf, and a single example of a somewhat larger insect with curiously formed hind-wings, *Krananda latimarginaria*,[1] Leech.

Besides the larger insects there were two of the delicate creamy, black-dotted Pyrale, *Entephria abdicalis*, Walk., and one of the Crambid, *Charltona kala*, Swinh.; together with these were a number of females of a Phycid which does not seem to be the same as any in the British Museum, but which Sir George Hampson is unable to determine in the absence of any male specimen.

An English lady, the wife of an officer of marines, who had spent some time in Hongkong, told us that somewhat remarkable theological results may follow from the too common practice of leaving English children under the charge of Chinese nurses.

SCENE.—A Hongkong drawing-room. A precocious little girl discovered playing with toys in the centre of the stage, around are Papa, Mamma, and other ladies and gentlemen drinking tea.

(A loud clap of thunder is heard without.)

Child, looking up from its play: "Big Topside man makee muchee tumtum; welly angly."

[1] At first I described this as a new species in the *Entomologist's Monthly Magazine* (1905, p. 184) as *Orsonoba orthogrammaria*. There were extenuating circumstances tending to condone the error, but it is not necessary to detail them.

Papa: "Who is Big Topside man?"

Child: "He live in Church, has black whiskers and black boots." (*Sensation.*)

MACAO, lat. 22° 21′ N.

April 12th, 1904.

The small steamer that plies between Hongkong, Macao, and Canton afforded a new experience. Soon after starting I was much surprised on going below to see a stalwart quarter-master marching up and down with a Winchester repeating rifle over his shoulder. On asking this formidable individual for an explanation I found that the Chinese third-class passengers were confined to the lower deck, being kept there by steel grids covering the hatchways and padlocked down! It would appear that the natives of the country about the Chu Kiang, mostly pirates by descent, have not yet entirely abandoned that profession,

"And it is, it is a glorious thing
To be a Pirate King!"

More than once in comparatively recent times the rascally passengers have risen and seized the vessels employed in this trade, so that the owners have found it necessary to supply sufficient stands of arms for the European members of the crew.

On this voyage fortunately no rising was attempted, and we reached the typically Portuguese town of MACAO in due course. This tiny settlement looks for all the world like a bit of Funchal, but that its streets are full of Chinamen, its harbour of junks and sampans. The forenoon of the next day was devoted to entomology, but unfortunately most of the available time was spent in looking for a good collecting ground. The country beyond the Portuguese boundary produced little besides the big Dragon-flies, which coursed up and down the innumerable ditches—appropriate enough to China. A visit to the very interesting garden of a wealthy Chinese produced nought but *Terias hecabe;* subsequent examination proved my three specimens to be respectively a fine large male of the wet-season form, a female of the dry-season form, which lacked the "dog's-head mark," and a similar female of extreme "dry" type.

A scrap of rough ground at the north-eastern corner of the settlement seemed the most promising spot, but by the time that I discovered it the day was far advanced. Here *Ganoris canidia,* the only White seen, was in abundance; a ♀ was very dark, a ♂ had a fairly strong sweet-briar scent. The little Blue, *Zizera argia,* f.

similis, was also abundant. Somewhat less numerous were *Neptis eurynome* and *Papilio pammon*, of the latter two males and a female of Wallace's Form I. (*cyrus*, Fabr.) were taken. In addition to these were a fair number of the handsome purple-glossed *Crastia amymone*, Godart, f. *kinbergi*, Wllgrn.; a female was observed to be hard to kill, while several males exhibited the acetylene odour, in one instance strong enough to be obvious when the butterfly was fluttering in the net. A single example of *Mycalesis mineus*, f. *chinensis*, together with the day-flying Chalcosiine moth *Pintia ferrea*, Walk., complete the short list. It would seem that I failed to hit upon the collecting ground of which Mr. Freedley had spoken to me so enthusiastically at Kandy. This day I tried my hand at Pidgin English, and found that I was quite understood when I said of the butterflies to an onlooker: "Fly muchee[1] fast: I old man no catchee can."

CANTON, lat. 23° 8′ N.

April 14th, 1904.

On the way up the Chu Kiang the most prominent object is Tiger Hill, standing opposite the famous Bogue Forts. This would appear to be one mass of rock, unbroken by either joint or bedding, and must weigh millions of tons, exceeding in size even the rocks I had seen in Southern India.

As we neared the landing-place the pack of sampans reminded me of Henley, especially as the propulsive power was mainly obtained from other boats, rowing being out of the question. Our boat-*woman* proved more than a match for all comers, alike in skilful navigation and in the readiness of her glib tongue. One felt instinctively that she boldly *said* what a man at Henley would scarce have dared to *think*.

We were carried in chairs, three men to each, through the streets of CANTON, the most interesting city that it has been my lot to visit, so full is it of strange life and vivid colour. The architecture is disappointing, but the streets, 7 feet wide, and their yellow, squinny-eyed, flat-faced occupants are most fascinating. We had some difficulty in diagnosing the comestibles exposed for sale, but believe that we did make out strings of dried rats, and possibly bêches-de-mer and birds' nests for soup. When I asked our excellent guide, Ah Sing, whether it was true that his countrymen ate dogs, he replied: "My countrymen, sir, are poor, they eat everything." The Chinese shopkeepers advertise their wares in such a way as to adorn,

[1] A Pidgin English scholar says "plenty" is the correct word.

not to disfigure the city. As you look up or down a street hanging boards a foot or so wide and 5 to 10 feet long call attention to the names of the tradesmen and the nature of their wares, set forth in ideographs of white, black, or gold upon a ground of blue, vermilion, or emerald green. The characters are picturesque in themselves, and the Chinese are unrivalled in their successful use of the boldest colour contrasts. There are no models or paintings of the goods for sale, such as were quite general in Prague forty years ago, so that it is fair to surmise that a large proportion of the population can read the difficult writing—writing, remember, in which each character (ideograph) represents not a letter, but a thing or idea. It is said to be necessary to learn 3000 to 4000 ideographs before one can read fairly fluently. One consequence is that a Japanese or a Chinaman can read the ideographs written by a man speaking a language quite foreign to him, a fact that proved of great advantage to the Japanese in their recent wars. Colour may be said to culminate in the Chinese pawnshop. There is no prejudice against pawning, and it has such obvious advantages that men in temporary straits think nothing of pledging their lovely embroidered garments.

Yet the native town of Canton is not the place that any one would choose to live in; it appeals strongly to other senses than those of sight.[1]

As in duty bound we were introduced to the executioner, but found that official somewhat depressed by slackness of trade. My late friend, Mr. E. A. Bonner, some two or three years previously had a great stroke of luck, for he looked in just in time to see seventeen heathen Chinese decapitated! It was said that in the fifties, in the days of Governor Yeh, the executioner was chosen by competitive examination of a highly practical character. The fortunate successful candidate was he who never failed to strike off a head at one blow. Such an ordeal required both skill and endurance.

Somewhat less practical were the examinations which have been conducted by the Civil Service Commissioners of China—or their equivalents—from time immemorial. The so-called Examination Hall is an area of several acres enclosed by lofty fortified walls, within which stand countless tiny houses or stalls, 6 feet × 4 feet. It is said there are 11,600 of these torture chambers, within which as many unhappy candidates toiled nervously at their old-time papers on the doctrines of Confucius, under the glaring eyes of the examiners, who invigilated on lofty towers in the midst. Three ordeals of

[1] It may, however, well be doubted whether in the matter of evil odours Canton excels some parts of Marseille.

24 hours each reduced the applicants to 88, who then had to go to far Pekin for a further process of elimination. The happy survivors, sooner or later, obtained appointments in the public service. And so it befell that this, the oldest and most elaborate Examination System that the world has seen, resulted in—perhaps the most incompetent body of officials in the world. I use the past tense, for we were told that the examination held the year before our visit was the last of the old régime—for in these days even China moves, or at any rate talks of moving.

Though the Canton Examination Hall is not much like the Schools of my own University, yet it seemed appropriate to take from such a spot some few specimens to enrich the cabinets of the Hope Department of the Oxford Museum. The courtyard was weedy enough to harbour such a domestic-looking butterfly as *Ganoris canidia*, one of them a dwarf, as well as the more interesting *Grapta aureum*, Linn., the Oriental Comma, which was flying about in some numbers. I also secured a single example of the Acraeine, *Pareba vesta*, Fabr., the only one that I have seen alive.

In the somewhat dreary and prison-like British Concession the insignificant *Zizera argia*, f. *similis*, was to be seen in abundance.

The voyage northwards along the China Coast is remarkable for the number of stacks, or isolated rocks, most of them bearing lonely lighthouses. We wondered much how the fishermen dared go so far out in the picturesque, but cumbrous and ill-sailing junks, and heard tales of the frightful losses in typhoons. But were the ships of our own navy between the days of Alfred and the Great Harry so very different?

On the night of April 23rd, after leaving Shanghai, when near the mouth of the Yang-tse-Kiang, a *Cirphis (Leucania) unipuncta*, Haw., came to the lights of the "Empress of India." It is a far-ranging species.

Whenever I have seen the Red Sea it has been blue, but we found the Yellow Sea true to its name. A Londoner like myself may venture to think that he knows something about fog; if, also like myself, he has been up the St. Lawrence and on the Banks of Newfoundland, he is apt to think he knows *all* about fog. Imagine, then, my surprise on learning from the captain that in the southern part of the Yellow Sea fog is so prevalent that it is often difficult to "make" Japan.

JAPAN.

NAGASAKI, lat. 32° 45′ N.

April 25th, 1904.

Japan! The land of incongruities.

We were guided into the harbour by a Government launch, for the Russian war was in full swing, and we had to thread our way through a mine field! A nation until recently one of the most conservative in the world, does not neglect any modern invention likely to be of service in its mighty struggle with the Colossus of the North.

The recurring necessity of coaling gave us the opportunity of landing, so we left the merry little Japanese women to their grimy task, and crossed over the hill to MOGI, a small fishing village on the other side of the peninsula. The country was pretty and all arrayed in bright spring colours. The crops were trim and tidy, the woods every shade of emerald and bronze, the wild flowers mostly of English type, *e.g.* two sorts of scentless Violet, a Potentilla, and the good old Dandelion. A prominent plant new to me was like Lucerne, but smaller, and with flowers the colour of Thrift; being used for fodder it gave much brilliance to the landscape both here and in other parts of the country. On the way to and fro (all too short) I got some delightful collecting. The Fauna even more than the Flora afforded illustrations of the strange mixture of the Oriental with the Palaearctic which is so characteristic of the Japanese archipelago, and which is, presumably, most marked in the southern island Kiusiu. Thus both *Zizera maha*, Koll., f. *diluta*, Feld., and *Cyaniris ladonides*, de l'Orza, had a very Palaearctic look, and the same may be said of the handsome Satyr with the terrible name, *Blanaida* (*Neope*) *goschkevitschii*, Ménét., of which several were seen, reminding me of large *Pararge megaera*, Linn. Moreover, even the fine *Papilio xuthulus*, Brem., is a good deal like *P. machaon*, Linn. On the other hand, the brown *Papilio alcinous*, Klug, has a distinctly Eastern look, while true Oriental magnificence was reached by the splendid blue-green *Papilio* (probably *maacki*, Ménét.) that I saw in the road and missed in spite of the polite assistance of a Japanese gentleman who was passing by and marked it for me. *P. alcinous* was quite common, and I secured two ♂ and one ♀. Unfortunately I did not examine this species for scent; Leech, quoting Pryer, says: "The ♂ emits a peculiarly sweet, musky odour

when alive. The ♀ also emits a fainter odour, but to me this is as unpleasant as that of the ♂ is pleasant."[1]

Continued rain spoiled the voyage through the Inland Sea. Its picturesqueness cannot be what it once was, for the junks have disappeared and all the fishing craft are schooner-rigged and more or less European (or perhaps American) in build. For did not the Mikado, after receiving the report of an Imperial Commission, issue an edict that "On and after such a date, every fishing boat should . . ."? Surely nothing less imperious could have changed the immemorial practice of such conservatives as fisher-folk are all the world over.

We duly reached KOBÉ, and after an inspection by the most polite of Medical officers landed and took train to KYŌTO. Two things impressed us on this journey: (1) the extraordinary noise made by the numerous passengers walking about the stations in wooden clogs of simple construction; they are held on by straps from a pin which passes between the big toe and the next. (2) The advertisements in the fields, more especially near the stations. England and America seemed to be outdone. Some of the signs were grotesque, a few artistic, but all insolent in their aggressiveness.

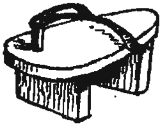


FIG. 6.—Japanese Clog.

KYŌTO, lat. 35° 3′ N.

April 28th—May 4th, 1904.

On coming out of the station we received a rude shock—everywhere telegraph poles and telephone wires, electric lights and electric trams! And this in the old capital of Japan; truly we had come too late.

However, a further acquaintance with the city reassured us somewhat, for we found all the women wearing the traditional national costume. Most of the men also wear native garments but in their case the effect was too often spoiled by the addition of a European hat or cap. The upper garments of adults of both sexes are usually of quite sombre colours, and give to the crowd a monotonous appearance that we had not anticipated. It is true that the under kimono (corresponding to the European petticoat) is commonly red, or of

[1] J. H. Leech, "Butterflies of China and Japan," p. 541, quoting H. Pryer, "Rhopalocera Niphonica," 1886, p. 4.

other bright tint, but this is rarely visible. The universal dark grey roof-tiles largely contribute to the dinginess of a Japanese town—a dinginess that was relieved mainly by the Wistarias now in full flower, and the quantity of red and white bunting displayed on all sides, for it was war time. There is one other pleasant piece of colour in a Japanese city, all jinrikisha men, licensed porters, street orderlies and such-like folk wear a very picturesque blue dress, in cut somewhat suggestive of that of a knave in an old-fashioned pack of cards, and adorned with large white ideographs.

The great war with Russia then in progress showed itself in various other ways. For instance, picture post-cards and other representations of incidents in the war, real or imaginary, were much in evidence, affording a strange combination of modern realism of the most sensational type with the traditional Japanese art. One night we went to the theatre, where we saw a patriotic war play. It was the high melodrama of old in an Eastern setting, quite outdoing the glories of Astley's. Men died several times over with the most vigorous contortions, and there was no lack of smoke and red-fire. The drama culminated in a Russian railway troop-train, which entered the house from behind the audience and passed by an elevated track above the heads of the spectators in pit and stalls on to the stage. Of course it was blown up, but that was not enough to gratify patriotism, and somehow it finished its wild career by going to the bottom of Lake Baikal, to the huge delight of the audience.

More sober and far more interesting was the procession of 1500 students with red paper lanterns through the streets of KYŌTO in commemoration of the recent victory on the Yalu. The crowd was enthusiastic, but I thought tempered by a realization of the cost—for the Japanese seemed to feel greatly the loss of life. I was with a party of ladies—suddenly the passing students realized that we were English and rushed at us to shake hands. For some minutes I was shaking hands (both) with as many as could get at me! There is no doubt that at the time of our visit the English were very popular.

Such time as could be snatched from sight-seeing and curio hunting was utilized in short excursions to the wooded hills around, with, as will be seen, but very moderate results.

The large Satyr *Blanaida goschkevitschii* was common. The hind-wing of this butterfly is markedly fluted, like that of *Pararge aegeria*.[1] A specimen at rest on a rock at Chūdō had no list, but the sun

[1] Longstaff, *Ent. Month. Mag.*, 2nd Ser., vol. xiv., 1903, p. 255.

was not shining at the time, and another specimen found nearer the city listed some 15° to either side. The only other Satyrine butterfly met with was *Yphthima philomela*, Johanss., f. *zodia*, Butl., being the extreme wet-season form; five specimens were taken close to the town. The hind-wing is fluted as in the preceding species.

The commonest Nymphaline seen was *Neptis eurynome*, the spring form, called by Moore *sangaica*. Of the familiar Palaearctic *Grapta C-album*, Linn., I took a single specimen.

The Blues were represented by five species, but only one of them, *Curetis paracuta*, de Nicév., with underside gleaming silver-white, was of distinctly Oriental character; of this a single individual was captured in a wood near Kyōto. The insignificant *Zizera maha*, f. *diluta*, as well as *Everes argiades*, Pallas, f. *hellotia*, Ménét., would seem to be widely distributed in Japan, but the commonest Blue in the Kyōto district was *Cyaniris ladonides*. The Small Copper, *Chrysophanus phlaeas*, Linn., f. *turcicus*, Gerh., naturally reminded one of home; it was common at Kyōto, and also occurred at Arashiyama, some five miles to the westward.

At most places that I have visited there is a Common White; at the old Japanese capital, and in the neighbourhood, *e.g.* at Kami Sakomoto, and Arashiyama, this was *Ganoris melete*.[1] The ♂ has a distinct, fairly strong, lemon-verbena scent, a fact confirmed by Major H. A. Pratt, R.A.; this butterfly is very nearly related to our *G. napi*, which is well known to have the same scent.

Terias hecabe, f. *anenome*, Feld. (? *mandarina*, de l'Orza), without black markings, was common in the woods at the foot of Mt. Hieizan and also at Arashiyama; those taken were of the wet-season form. Of the singularly shaped Orange-tip *Euchloë scolymus*, Butl., three specimens were secured.

The three Swallow-tails, *Papilio demetrius*, Cram., *P. machaon*, Linn., and *P. xuthulus* (the spring form of *xuthus*, Linn.), were all common, indeed one or other of the yellow species was not infrequently seen in the principal streets, where it seemed quite in keeping with its artistic surroundings.

Two specimens of the black *Halpe varia*, Murray, occurred on Mt. Hieizan—rising about 2700 ft. some four miles to the north-east of the city; with them were several of the commoner Japanese

[1] Dr. F. A. Dixey says that my specimens do not agree with Ménétriés' description, but do agree with Leech's figure. They are the *G. aglaope*, Motschulsky, which is identical with *megamera*, Butl., and is, according to Leech, the Japanese spring form of *melete*, Ménétriés.

Skipper *Tagiades montanus*, Brem., an insect that reminded me of *Euclidia glyphica*, Linn.

I took but few moths at Kyōto: *Anagoga indictinaria*, Brem., was common in pine-woods; of *Abraxas miranda*, Butl., I got two; but of the curious day-flier, *Pterodecta gloriosa*, Butl. (*felderi*, Brem.), I only secured one, while *Zettienia albonotaria*, Brem., came to light.

The Dragon-fly *Mnais costalis*, Selys, was to be had in abundance, but of the Caddis-fly *Perissoneura paradoxa*, McLachl., I got but one. On Mt. Hieizan I captured one of the pretty *Cicindela japonica*, Guér., while the allied *Calochroa chinensis*, Cram., was rather common; on the same mountain one *Carabus eccopterus*, Kz., was secured.

The Nakasendō.

May 7th—May 10th, 1904.

Our best view of Japanese scenery, and incomparably our best insight into the ways and manners of a most interesting people, was gained on our four days' journey, partly on foot, partly by jinrikisha, along so much of the old high road from Kyōto to Tōkyō (known as the Nakasendō, or Central Mountain Road), as extends from Nakatsugawa to Oya, 109 miles.

The road lies entirely within the inland province of Shinshu; probably no part of it is less than 1000 ft. above the sea, the greater part between 2000 and 3000 ft. It is rough and in parts barely passable for jinrikishas, especially where it crosses the three passes:—Torii-tōge, 3150 ft.; Shiojiri-tōge, 3340 ft.; and Wada-tōge, 5300 ft.

Our first acquaintance with a native inn was made at Nakatsugawa; on approaching the door I was not a little disconcerted by the landlady and her daughter prostrating themselves on either hand and touching the ground with their foreheads! No English guide to etiquette tells one what to do under such trying circumstances; which should be picked up first, mother or daughter?

Again, what was one to do when shown to one's room? This was a box of wooden frame-work, at least three sides consisting of sliding shutters with paper panels; the floor covered with exquisite matting spotlessly clean. On the one immovable side, in an alcove, hung the *one* kakemono; on a shelf stood the *one* curio and the *one* flower-spray in water. In the centre of the room stood a table some ten

inches high for tea, and by it an iron, or bronze, brazier for kettle, pipe, and the warming of hands. *Voilà tout!* Anything more absolutely unlike the busy fussiness of an English lady's boudoir *à la Japonais* could scarcely be conceived. What, I repeat, was one to do? As a fact I sat down on the floor and felt like a new doll plumped down in a strange doll's house. While thus engaged, or it might be while dressing or undressing, a panel in the wall would noiselessly open, and a woman enter, cross the room, and disappear ghost-like through the opposite wall (for it is possible to walk right through a Japanese house in any direction). As the intruding lady manifested neither surprise nor abashment at my presence, why should I object to hers?

In these country inns the bedding consists of a number of very thick cotton quilts laid upon the floor, the guest insinuates himself at any desired level, under one, two, or three quilts according to the temperature—an excellent arrangement. Washing is done in a copper basin at a sink in the public passage, where soap is allowed; not so in the hot bath, *the* great Japanese institution. Out of deference to our prejudices we were taken one by one to the bathroom, and as a very special attention the hand-maiden closed the door. The natives sit in rows in the bath, usually with the door open. A clergyman who has spent many years in the country told me that when the Mikado not long ago issued an edict stopping mixed bathing, the police in some cases, as a transition measure, were satisfied if a string was stretched across the bath with notices on either side: "for ladies," and, "for gentlemen!"

Mais, revenons à nos moutons: several butterflies were taken the first day, May 7th, along the lower part of the road,[1] *i.e.* below 2000 ft.; such were the big before-mentioned Satyr *Blanaida goschkevitschii*, of which but one was captured, though others were seen; *Argynnis anadyomene*, Feld., a Fritillary recalling *paphia*, of which two were taken on mud in the road; *Dichorrhagia nesimachus*, Boisd., a nearly black Nymphaline butterfly with a weak fluttering flight, of which a single specimen was taken on a white dusty road, where, with its wings fully expanded and appressed to the surface, it was very conspicuous; our old friend *Pyrameis cardui* turned up, a worn specimen; of *Libythea lepita*, Moore, one was taken and another seen, both by the road on the first day of the expedition; three Swallow-tails come into the same category—*Papilio macilentus*,

[1] This was written four years after the journey, and as my notes do not in all cases give the details it is quite possible that some of these species may have been seen at greater elevations.

Janson, and *P. demetrius,* which were common, and *P. bianor* (*de-haani,* Feld.), of which several were seen.

Some species, on the other hand, were not met with (or at any rate not captured) below 2000 ft., and were mostly seen between that altitude and 3000 ft. Such were *Vanessa io,* Linn., of which I took a somewhat small and dull coloured specimen, and Major Pratt saw another; *V. antiopa,* Linn., a specimen was seen by Mrs. Pratt; of the common Blues, *Cyaniris ladonides* and *Everes argiades,* var. *hellotia,* two each were taken, on the Shiojiri-tōge,[1] at about 3100 ft. I secured two of the very distinct *Satsuma ferrea,* Butl., which is steely-blue above, black beneath, with gimped wing margins—very Japanese-looking. Pierines were fairly numerous; females of *Gonepteryx rhamni,* Linn., were abundant up to 3000 ft., especially above Fukushima; one specimen had been so pecked by a bird as to make a notch on all four wings in the part where they overlap when the butterfly is at rest; only a single female was netted, and tbis was faded and worn as if it had hibernated. Of *Leptosia amurensis,* Ménét., the Eastern form of our Wood-White, several were taken on the Shio-jiri-tōge; flying with it was the even more familiar *Ganoris rapae,* Linn. The males of the last-named had the characteristic sweet-briar scent; a female was very dark. At about 2000 ft. I was much interested in taking a specimen of *Parnassius citrinarius,* Motsch.; possibly others were seen, but it was not practicable to stop to pursue them. Near Wada, *circa* 3500 ft., at about 3 p.m. on May 10th, a gorgeous peacock-blue Swallow-tail was seen quietly flitting to and fro over a small flooded paddy-field; at first it looked as if wet feet and muddy legs would be needed for its capture, but patience was rewarded, the sacrifice proved unnecessary, and a magnificent specimen of *Papilio maackii,* Ménét. (*tutanus,* Fenton) was secured. It is possible that a butterfly seen on May 7th, on lower ground, belonged to the same species. [Plate I., Fig. 5.]

To this list of Highland forms may be added *Hesperia maculata,* Brem. & Grey, like our *Syrichthus malvae,* Linn., but handsomer; it was common above 2300 ft. Another Skipper, *Tagiades montanus,* which was common throughout the journey, occurred at the summit of the Torii-tōge, at a height of 4000 ft.

Other butterflies that were found indifferently on higher and lower ground were *Neptis sangaica* (this was, however, distinctly commoner the first day, on the lower part of the road); *Euchloë scolymus,* which was not common; *Ganoris melete,* in some numbers,

[1] N.B.—Tōge = pass, San, Zan / Yama } = mountain, Kawa / Gawa } = river, Shima = island.

the male with a strong lemon-verbena scent; and *Colias poliographus*, Motsch. (the Far-Eastern form of *hyale*, *auct.*). This last, the Japanese Pale Clouded Yellow, occurred on each day of the expedition, but between Niegawa and Shimono-suwa, at from 2000 to 3000 ft., was quite abundant—indeed I even succeeded in netting a specimen from my jinrikisha! *Papilio machaon* (several of the specimens very pale) and *P. xuthulus* were both common throughout, the latter extending up to our highest point, 5500 ft., above the summit of the Wada-tōge.

I only brought away two moths from this expedition, both Geometers. *Abraxas miranda* occurred at about 2000 ft., while *Panagra petraria*, Hübn., was found in a wood at about 3500 ft.

The Caddis-fly *Stenopsyche griseipennis*, McLachl., came to light at Oya, *circa* 2000 ft., on May 10th. The next morning I took at the same place *Chrysophanus turcicus*.

At Karuizawa, 3300 ft., on May 11th, I met with *Pyrameis indica*, Herbst, as well as the large *Notodonta*-like Geometer, *Pachyligia dolosa*, Butl., while the small black Arctiid *Diacrisia caesarea*, Goeze (*Chelonia luctifera*, Esp.), came to light.

On May 12th we ascended Asama-Yama, 8280 ft., the highest of the active volcanoes of Japan. The ascent is quite easy, being for the most part over small scoria, but we were unfortunate in our weather. The strong smell of sulphur declared our proximity to the crater, but the cloud was so dense that we literally could not see more than five yards; moreover, the wind was so strong that it drove the rain horizontally, while every now and then a stronger gust than usual sent us staggering. Any idea of a view was out of the question, and common prudence suggested that our position was not without danger, so we had to beat a rapid retreat. The next morning it was tantalizing to see from the train the summit of Asama-Yama far above the clouds, with a wreath of steam slowly rising from the crater—the very ideal of peaceful repose.

NIKKO, lat. 36° 45′ N. alt. *circa* 2000 ft.

May 15th—17th, 1904.

Quite apart from the wonderful temples, the great *Cryptomeria* avenue, and the curio-shops, NIKKO left a most vivid entomological impression on my mind.

Together with the now familiar *Blanaida goschkevitschii* was the wet-season form of the comparatively insignificant *Yphthima zodia*. In a wood at the foot of Toyama, at an altitude of some 2100 ft., the

pretty *Araschnia burejana*, Brem., was not uncommon; *Neptis sangaica* was in larger numbers, while but two *Grapta C-album* were taken. The Blues were represented by two *Everes argiades*, f. *hellotia*, but at the summit of the small wooded hill Toyama *Cyaniris ladonides* was in abundance though worn. This pretty knoll culminates in a tiny ruined temple of very remarkable construction. It is of wood to which thin slabs of lava are cramped vertically, just as weather-boarding is fixed on old river-side cottages in England. Near Kyōto, on Mt. Hieizan, we had seen a granite bridge of essentially timber construction, with mortices and tenons, and even *wedges*, all of granite. At Fathipur Sikri we had seen the famous local red-sandstone used so as to imitate roof tiles and wooden beams. This precedence of the joiner's craft in the East is a curious contrast to the history of the building arts in mediaeval Europe, for our cathedrals and churches clearly show that joinery in the West developed from masonry.

Around that tiny fane, quite indifferent to its structural peculiarities, coursed innumerable Swallow-tails of four species. Of these, *Papilio demetrius* is represented by but one specimen in my collection, but *P. bianor*, and the magnificent *P. maackii*, were both in abundance, while with them, in even greater numbers, was *P. machaon*, often flying in threes and fours together. *Machaon* would occasionally settle on an Azalea flower; not so the others. None of these Papilios were common on the sides, or at the foot of the hill. Why did they behave in this manner? I wish I could tell whether both sexes were so occupied.

Other common Nikko butterflies were *Colias poliographus* and *Papilio macilentus*. Late in the afternoon I was able to catch the latter in my fingers; the Papilios take a long time selecting their night quarters, and are then very leisurely in their movements. Of *Ganoris melete* I took but one at Nikko, a female; of the Skipper *Tagiades montanus* I captured two, one on Toyama, the other at Chuzengi at a height of 4000 ft. Another Skipper, the pretty black and white *Daimio tethys*, Ménét., was abundant, especially on the slopes of Toyama; though conspicuous when settled, it was hard to follow on the wing.

At Nikko a fair number of moths were secured; conspicuous among them was the singular *Pterodecta gloriosa*, a day-flyer which I had previously met with at Kami Sakamoto, near Kyōto. Another day-flyer was the Ermine *Diacrisia punctaria*, Stoll; I believe (but am not sure) that the black and white Geometer *Odezia aterrima*, Butl., var. *moeroraria*, Frr., had similar habits, but the majority of the Geometers noticed were kicked up from the herbage as one

walked along: viz. *Zettienia albonotaria*, *Z. rufescentaria*, Motsch., and *Hygrochroa subspersata*, Feld., these three all among Cryptomerias; *Epione advenaria*, Hübn., which I have never seen alive in England; *Epirrhoë supergressa*, Butl., which is very like our *Melanippe unangulata*, Haw.; a very worn *Scotosia* sp.; the Argent-and-Sable, *Melanippe hecate*, Butl.; *Phibalapteryx tersata*, Schiff., which I have also taken in my garden at Mortehoe; *Abraxas miranda*, and *Microstega (Botys) pandalis*, Hübn., another British species; on the other hand, *Anagoga indictinaria* came to light. Another familiar Palaearctic species, *Ectropis (Tephrosia) consonaria*, Hübn., was taken at rest on a beech-trunk at Chūzengi, above Nikko. At that altitude, 4370 ft., the trees were leafless, and in some parts the woods suggested England in March—but this was only on one side, on the other the prevalent underwood consisted of *Azalea*, now in full bloom, white, orange-red, purple-crimson, and salmon-pink. A hill on the way up, perhaps 300 to 400 ft. high, was a glowing mass of red.

Nikko looked like a good place for Neuroptera, but I had not time to pay attention to the group. A solitary Dragon-fly, *Gomphidia* sp., is represented in the British Museum by unnamed Japanese specimens. I brought home also two Caddis-flies, *Stenopsyche griseipennis*, which came to light, and *Sciops (?) octomaculata*, McLachl.

Yokohama.

May 19th, 1904.

About the racecourse several insects now reckoned as old friends were met with, such were *Papilio machaon*, of which a tattered specimen was taken; *Colias poliographus*, a male; and *Zizera maha*, var. *diluta*. The wet-season form of *Yphthima zodia* was abundant, but of the black Skipper *Halpe varia* I took but a single specimen. The only moth was a small Pyrale, *Pyrausta varialis*, Brem. The last butterfly that I saw in Japan was the same species as the first, *Blanaida goschkevitschii*; this was in abundance; late in the afternoon it was constantly seen to settle on the sunny side of pine trunks, when it would list to port or starboard indifferently, often as much as 40°. While watching these butterflies a Dragon-fly, almost certainly *Orthetrum japonicum*, Uhler, of which there were plenty hawking about, was seen to carry off one of these big Satyrs high into the air; they both went far out of reach, but as far as I could see the butterfly showed no signs of struggling.

THE PACIFIC OCEAN.

May 20th—31st, 1904.

Japan was left under a sense of great depression. To the natural feeling of regret at leaving such an interesting country after an all too short visit was added a very real sympathy with our kindly hosts in the loss of a battle-ship and a cruiser announced in that morning's papers.

It is impossible to omit some account of my impressions of that wonderful country. Of these the first, and the last, relates to their "wee winsome women." The daughters of the Empire of the Rising Sun are not, according to our canons, either beautiful[1] or graceful; their wondrous dress gives them figures decidedly suggestive of pillows, and yet they are beyond all women charming! Of course this apparent paradox is to be explained by their unequalled, unapproached manners. Not merely do they lay themselves out to please, but their every act is performed as if it gave themselves the greatest possible pleasure in the performance. Cynics may say that it is all artificial, all a matter of education, so be it: the Japanese system of the education of women is thereby proved to be the most successful in the world, and the sooner that our Newnham, Girton, and Somerville girls go to Japan to learn manners the better for us Englishmen—only one hopes that they will not spoil their Japanese sisters.

As before said, Japan is by no means remarkable for bright colouring, yet, strange to say, when it rains it bursts out as it were into bloom, for then the transparent (? oiled, or waxed) umbrellas display their yellow and orange tints, while the women lift up their kimonos and expose a scarlet, or otherwise brightly coloured garment which corresponds to an English woman's petticoat.

No observant traveller can fail to note the influence of Nature on Japanese art. The weird growth of stunted pines upon the mountains, distorted by the prevalent winds; the aspiring fluted trunks of the lofty and solemn *Cryptomeria japonica;* the graceful curves of the bamboo; the peculiar growth of the maple, are all reflected in Japanese pictures and lacquers. Again, not to speak of the familiar chrysanthemum and the cherry blossom, there is the common wayside *Pyrus japonica* with its eminently decorative red flowers.

[1] An exception must be made in favour of the complexions of the country girls: brunette with a bright scarlet flush in the cheeks—a touch of colour as beautiful as unlooked for.

We were lucky in seeing that grand climber, the *Wistaria*, in perfection. In its wild state it frequently fails to hold its own, but when it has succeeded—when it has climbed 80 to 100 feet up a suitable tree, and its flowers hang in a very waterfall of lavender-coloured blossom, it is truly a glorious sight. The white species, whose countless racemes are often seen hanging from light bamboo frameworks about houses and gardens, is equally beautiful. Then there are the Azaleas on the mountains, white, or every shade of red, so that the very woods glow with the warm colour. A shrubby *Potentilla* is as common as it is decorative; the Japanese Bramble is as beautiful as it is singular. To these may be added the Solomon's-Seal, a magenta-coloured Lucerne, several ferns allied to *Osmunda*, a fine wild Strawberry which is unfortunately quite tasteless, and the now quite familiar *Ampelopsis veitchii*. Lastly, while there are white roses the size of sixpences, there are others as big as teacups.

The Japanese artists conventionalize in such a masterful manner that it is always possible to tell the genus of a decorative insect, often (especially with the Swallow-tails) even the actual species, so well are the essential characters caught and fixed.

Lastly, while the form of Fuji-no-yama is now almost as familiar in Europe as in Japan, it is probably not so well known that the fantastic outlines of other mountains in their pictures are largely based on the weird, almost grotesque forms of the crags of Myōgi-san, between Karuizawa and Tōkyō. Indeed the Japanese have an almost child-like love of anything approaching the grotesque in Nature.

Japanese poetical feeling was well shown by the congratulatory telegram sent by the Mikado to Edward VII. on his coronation :—

"The Emperor of the Land of the Rising Sun congratulates the Emperor of the Realm on which the Sun never sets."

The Japanese are the most polite people that I have as yet come across; they are also by far the cleanest, and constantly put one to shame in that respect. Japanese crowds have justly been described as the sweetest in the world. This reminds me of a piece of advice that I would give to any European travelling in Japan. At the port of debarkation supply yourself with socks constructed to accommodate the great toe by itself, and have a pair of house sandals made to your own size (which, whatever your stature, will probably be far bigger than any kept in stock). These may be carried in a small cotton bag and worn whenever a house, or shop, or temple is entered. It is cold to walk with only stockinged feet, boots are out of the question, and the best form of sandal, with a

pin to go between the big toe and the second, can only be worn with the special socks. The writer suffered much inconvenience from having to make the best of sandals of the other pattern that constantly slipped, and were most uncomfortably small.

The Japanese with all their politeness are, at all events in country places, very full of fun and would laugh heartily at our party, while they had not the slightest objection to us in our turn laughing at them. The first time that we essayed chop-sticks the landlady and her daughter were literally convulsed with laughter—they bent double and rolled from side to side! It may here be remarked that they bid fair to rival the Swiss as hotel-keepers.

The lower orders, though very short, are almost grotesquely muscular. The upper classes are said to be less strong, but judging by the officers, their stature seems equally small. So far as I could see, the people, and especially the children, looked wonderfully healthy and robust. The only ailment that obtruded itself was an eruption on the scalp, and that did not appear to impair the general health of the children afflicted with it.

The "Empress of Japan," though not large, has, like her sisters, beautiful lines, looking more like a very large private yacht than a mail steamer. Of all the steamers that I have sailed on I know none to equal those of the "C.P.R." The discipline is splendid;[1] the service (all the stewards are Chinese) excellent, the table equally good. On Sundays we had strawberries and cream, while there was a very fresh-looking rose on every lady's plate.

Our voyage was scarcely a pleasant one owing to fog and wet. We were once six days without "sights" and found ourselves some 35 miles north of our proper course. This, however, is considered, under such circumstances, not to be a very great discrepancy between ascertained position and dead reckoning. When the weather would permit, hockey on deck was a great institution, especially as it was distinctly cold. For my part I had not played the game for forty years, and enjoyed it immensely.

A curious feature of this voyage was the outbreak of what can best be described as an epidemic of Patience-playing. For days there was played scarcely a game of bridge or a rubber of whist; even more surprising, not a game of poker or nap. Morning, noon, and night every available table in drawing-room and smoking-room alike was occupied by Patience! Young and old, men and women, all played "The Demon." Even the sporting fraternity, when not

[1] At drill all the boats were lowered a fathom or so from the davits within nine minutes.

itself engaged in the prevailing pastime, stood around absorbed in watching the players, quick to see a slip, for had they not heavy bets on the result?

But accounts of voyages are as dreary as the voyages themselves. There was, however, an even larger crop of stories than usual, of which I recall the following.

A Japanese gentleman, who had been poring over an English phrase-book, was anxious to air his newly acquired knowledge. Accordingly, on meeting an Englishman at a railway station he politely raised his hat and said: "Good evening, Sir or Madam, as the case may be."

Two Scotsmen and a Frenchman shared a cabin one night on a Channel steamer; the vessel pitched and rolled heavily, and two of the three were not happy. One of tbe Scots had the irritating habit of snoring in a crescendo till he would wake with a start. His fellow passengers resented this, more especially the Frenchman. Once again the stalwart Scot began his crescendo, and as he was working up to his loudest the vessel gave a heavier lurch than usual. Accordingly he gave vent to a louder snort than ever, after which he subsided into absolute quiet. "Grâce à Dieu!" said the Frenchman, "il est mort."

An American bishop from Shanghai told us that the only means of communication between the Italian nuns, who do the nursing in a hospital there, and the foreign sailors who make up a large part of their patients, is Pidgin English. Some English seamen came one day to inquire after a ship-mate who had met with a serious accident. The sister-in-charge said: "He topside walkee last night." They accordingly went upstairs, but failed to find him in the upper ward, and only gradually realized that he was *dead*.

The same bishop gave us the substance of an English essay on 'The Cat," written by a Chinese pupil in a mission school:—

"The cat is one of God's best gifts to man, therefore He, in His mercy, endowed him with nine lives. These, however, are not so useful in China now as formerly, since the introduction of Christianity."

As a piece of English literature this effort of the Yellow-boy may be well considered to attain the high level of the classic treatise of the Bengâli babu on "The Horse":—

"The horse is a noble animal, but does not always do so."

We had on board a vulgar girl, who hailed from Chicago; she was the possessor of a particularly unpleasant voice, and one afternoon at tea she behaved in a noisier way than usual. A very taciturn man at my side said: "If I had that voice I would hire myself out as a fog-horn on the Banks of Newfoundland." It is said to have been the misanthrope's only remark at meal times during the whole voyage.

Another of our first-class passengers, an Englishman, paid a visit one day to an Austrian gentleman in the second-class, when the following conversation took place:—

Austrian: "Dere is one Professor von Mesmerism on board; I would take some lessons, but he says I must pay £5."

Englishman: "Of course you won't do that."

Austrian: "Ach! no, two or dree will join togedder and make one class. How much do you tink we should pay?"

Englishman: "*I* wouldn't pay a d——n."

Austrian: "How much is a d——n?"

Englishman: "Two shillings and fourpence."

[*Exit Englishman to first-class, leaving Austrian considering ways and means, and the difficulties of the English coinage.*]

We reached Victoria, Vancouver Island, on May 31st, 1904.

CANADA.

Victoria, Vancouver Island, lat. 48° 25′ N.

June 1st, 1904.

Notwithstanding the many excellent points of the good ship "Empress of Japan," we were none of us sorry when the cold, wet, weary voyage came to an end, and we got our first sight of British Columbia.

The park of Victoria was one glorious blaze of gold, such Broom I never saw. Introduced not very long ago, I am told, it now bids fair to oust many of the native shrubs. Here I saw a number of Whites of very ordinary appearance, but flying among the grass were many of a Heath new to me, *Coenonympha elko*, f. *ampelos*, W. H. Edw., like a large pale *pamphilus*.

In the afternoon an old friend, Dr. George Hewlett, R.N., of H.M.S. "Bonaventure," then lying at Esquimalt, took me for a

delightful drive into the forest. We had a pleasant ramble under the sombre spruces, talking of past times in Bermuda, Nova Scotia, and Newfoundland, but unfortunately it clouded over and drove most of the butterflies to roost; we saw only *Grapta faunus*, Edw., of which I managed to secure one out of several seen, and *Papilio glaucus turnus*, Linn., of which I saw a single example. Of the last I took a broken one the next day at Vancouver City.

At VANCOUVER I had an experience which was as fortunate as it was curious. Though provided with through tickets to London, I had landed at Victoria with my supply of ready money almost exhausted. Vain endeavours to find a lost piece of baggage occupied most of my few hours in the city, so that the visit to the Bank of Montreal was postponed until uncomfortably near the hour of the departure of the train. The question arose in my mind how I was to give the bank proof of my identity. It was true that I had a letter of introduction to an old lady living somewhere in the place, but she might think it strange if I called with a cab and asked her to accompany me to the bank. Accordingly I kept her in reserve, and, resolving to try to bluff it through, walked boldly into the bank. As I entered, the teller in his wire thief-proof cage addressed me by name, and said he knew me well and my father too! "That's a good thing," said I, producing my letter of credit, "for I want to raise the wind." He glanced at the document saying, "And I know your signature too; it is thirteen years since I have seen it, but it has not changed." This gentleman had been a junior clerk in a bank with which both my father and I had accounts. I had not the slightest difficulty in getting money forthwith, and was passed on to other branches of the bank along the line of route.

NORTH BEND, B.C. 425 ft.

June 3rd, 1904.

Our journey across the Nearctic continent was a mere rush, affording few entomological opportunities; it would indeed not be worth recording save as my first, and only, experience of collecting in North America. It is true that on the occasion of the visit of the British Association to Canada in 1884, I had got as far West as Laggan, but on that journey I did not collect. When I visited Bermuda, Nova Scotia, Newfoundland, Quebec, and Niagara in 1901, my only entomological notes were of the abundance of *Nomophila noctuella* at Bermuda; a single specimen of *Papilio* (probably) *glaucus turnus*, seen on a hill above the Codroy River, Newfoundland, and

the very large number of white butterflies seen just outside Toronto Station.

NORTH BEND, in the gorge of the Fraser River, once famous as a gold-washing station, consists of a charmingly situated hotel, under the excellent management of the C.P.R. A walk along the track down as far as China Bar, possibly seven miles, was thoroughly enjoyable and gave one an insight into the fauna and flora.

Two plants stamped themselves upon my memory, the long-stalked Western Daisy (*Bellis integrifolia*, Michx.), and the very graceful orange-and-scarlet Columbine (*Aquilegia canadensis*, Linn.), which were both in profusion. There was also a bright-red Tiger-lily.

Butterflies were fairly numerous. The most abundant was a dingy little Skipper, *Thanaos persius*, Scudder (very like our *tages*), with these were a fair number of the much larger *T. juvenalis*, Fabr. Other Skippers were the small black *Amblyscirtes vialis*, Edw., and the more cheery-looking *Hesperia cespitalis*, Boisd., of each of which three were captured. The little brown, almost tailless Hairstreak, *Incisalia irus*, Godart, was common, and if dull, at least distinct. The purple-glossed Copper, *Chrysophanus* (*Heodes*) *helloides*, Boisd., was fairly common. The Blues were represented by the tiny, tailed *Everes comyntas*, Godart. A more decidedly American insect was *Phyciodes tharos*, Drury, of which the spring form was to be seen in plenty. This genus, confined to the New World, consists of pretty little butterflies allied to and resembling *Melitaea*. More striking Nymphalines, but yet of a more Old World look, were *Vanessa californica*, Boisd., of which I saw but one battered individual, and *Grapta faunus*, which has similar habits to our Small Tortoiseshell, but is more fond of settling on the leaves of trees and shrubs; the specimens taken were worn. I did not see any Satyrs.

Of the Pierines I met with three species. *Ganoris oleracea*, Harr., is a geographical race of *napi*, and accordingly the only specimen netted, a male, had a distinct lemon-verbena scent. *Ganoris rapae* was introduced into the New World early in the second half of the nineteenth century, having appeared near Quebec in 1860. Prof. Comstock says that it reached New York in 1868, and since then has greatly reduced the numbers of the native *oleracea*, driving that species from the gardens into the woods. In England *rapae* is unquestionably a garden butterfly, *napi* being commoner in woods, fields, and lanes. It is most interesting to learn that prior to the invasion of *rapae*, the American form of *napi* frequented gardens. Anyway I saw several *rapae* that day at North Bend, where gardens

are few and far between; it had brought its sweet-briar scent with it from Europe. The other Pierine was *Colias chrysotheme*, Steph., f. *philodice*, Godart, of which I saw several, and took one of each sex.

The Swallow-tails were represented by the fine yellow *Papilio glaucus turnus*, which was rather common.

Moths were not at all prominent, a worn-out Acidaliid could not be named; of the Quadrifid Yellow Under-wing, *Syneda divergens*, Behr., which seemed to be a day-flier, I took two; I also got two, one of each sex, of the handsome day-flying Saturniid, *Pseudohazis eglanterina*, Boisd.

A week divided between Glacier House, in the Selkirks, and Lake Louise, in the Rockies, was devoted to mountaineering of a mild kind, though rain sadly curtailed our operations. At that time of the year (beginning of June) the snow-line was so low at Glacier as almost to reach the railway track, so that the ascent of Mt. Abbott (8500 ft.), in August a "grass mountain," had to be made with a Swiss guide over snow all the way. The usual path was broken by a somewhat menacing snow cornice, so that we had to make a wide detour and traverse a slope where we would have been glad of a rope. However, our descent was much accelerated by glissading.

On our way to the Asulkan (wild goat) Glacier we crossed the track of a considerable avalanche, under which the river made its way, and were surprised at the force of the *Lawine Luft*, or blast of wind caused by the avalanche, many quite large trees having been broken in half. Had not the guide Feuz assured me that this was the cause, I could never have believed it. We saw several marmots on the snow, and tracks of mountain goats and foxes.

The views were everywhere superb, and indeed much more imposing than they can possibly be after the melting of the snow. I had seen a few of the peaks in 1884, but they were for the most part strangers, nevertheless I seemed among old friends since I had met many of the men after whom the mountains had been named, *e.g.* Sir John Abbott, Douglas Freshfield, George Dawson, W. F. Donkin, Prof. Macoun, Sir Richard Temple, and Sir Charles Tupper.

From the Great Divide of the Rockies to the mighty St. Lawrence the route was not new to me, for I had traversed it just twenty years before. Many of the changes I was unable to see, since the train passed in the night some of the places of which I saw most in 1884. At Banff, for instance, in 1884, Mr. William Barnard and I slept on the not very clean floor of the section house. On a cold September morning we went out to draw our washing water from the well, and

while drying ourselves the sponges froze as stiff as boards. After breakfast we had sallied forth, crossing the deep, dark, swift Belly River on three logs lashed together, then, traversing a swamp (where I found a fine skull of a Caribou), made our way to the hot sulphur springs, enjoying a warm bath therein, though the vegetation around was glistening with hoar frost. Now Banff boasts a large hotel and is a tourists' centre. In parts of the prairie the extension of settlement was considerable, in other parts the change was not so marked.

At Winnipeg, in 1884, we had seen several teams ploughing Main St., to reduce the stiff clay mud to a moderately even surface with a view to paving it. This had in the interval been fairly successfully accomplished, but it was very sad to find that the City Fathers had pulled down the *one* historic building of Winnipeg—old Fort Garry—rather than suffer the continuation of Main St. to deviate a few yards from the straight line!

At Winnipeg Station a young porter came up to me and said: "I expect you knew my grandmother." I did not wish to appear surprised, but it was natural to ask, "Who may your grandmother have been?" To this the porter readily answered, "Mrs. Pinneger, pew opener of Holy Trinity Church, West Hill." It appears that he had read the name upon my luggage and made a good shot at my identity. As a result I had to deliver a message to the Vicar of Wandsworth, as well as to the Bank Manager.

Rat Portage, Ontario West.

June 13th, 1904.

This spot, once a busy gold-mining centre, lies almost equidistant between the two oceans. A stroll on the shores of the Lake of the Woods gave me another glimpse of the Canadian butterfly fauna. Several species seen at North Bend, more than a thousand miles to the westward, were met with again here, to wit: *Ganoris oleracea*, both sexes; *Colias chrysotheme*, a small male and two females; and *Everes comyntas*, one; as well as *Phyciodes tharos*. This last, which might almost have been called abundant, is fond of settling with half-expanded wings in moist, grassy places in woods. In addition to these, several species that were new acquaintances turned up. Of *Euchloë creusa*, Dbl., & H., I saw but one. Two Blues were in abundance, *Cyaniris ladon*, Cram., f. *lucia*, Kirby (being the northern spring form), and *Plebeius* (*Cupido*) *couperi*, Grote & R. The company was completed by the *sylvanus*-like Skipper, *Atrytone hobomok*, Harr., of which several were seen settling on mud where

it was hard to catch them. It is not at first quite apparent why American entomologists, having given this innocent looking fly a picturesque Indian name, familiarly speak of it as "The Mormon"; for the dimorphism of its female is as nothing compared with the polymorphism of some Papilios. Flying freely in the sun among the butterflies was *Euclidia cuspidea*, Hübn., a near relative of our *E. mi*, Clerck. Many bushes were infested with a larva having an interrupted pale dorsal line, which I took to be a *Clisiocampa*.

CHALK RIVER STATION, ONTARIO EAST.

June 15th, 1904.

A rapid raid from the train yielded booty in the shape of two *Brenthis bellona*, Fabr., a small Fritillary resembling *selene*, but without silver spots beneath.

THE MOUNTAIN, MONTREAL.

June 16th, 1904.

A short afternoon in Montreal's beautiful park was my last chance of studying Canadian butterflies in the field. The most obvious was *Colias chrysotheme*, but it was swift of flight and very wild, so that it was only at the cost of much exertion that I secured a male. A worn *Brenthis myrina*, Cram., was even more like *selene* than is *bellona*, since the resemblance extends to the under-side. The little bright fulvous *Atrytone hobomok* was the commonest butterfly, sitting on flowers in the same attitude as our two Common Skippers, and with it I took two *Euclidia cuspidea*.

When the fine SS. "Bavarian" reached the landing-stage at Liverpool I had girdled the top of the world.

Using round numbers, I was five months in India, three weeks in Ceylon, a fortnight in China, a month in Japan, and a fortnight in Canada—say eight months in all. During that time, in spite of many distractions, I managed to collect 2164 specimens, of which no less than 1867 were butterflies of 268 different species.

CHAPTER IV

ALGERIA. FEBRUARY 6TH—APRIL 3RD, 1905

ALGER

February 6th—14th.

THE "Général Chanzy" was not a comfortable steamer: her Clyde builders would appear to have given her lines that facilitated rolling on the very slightest provocation, and her French owners by no means exemplified the whilom adage, "they manage these things better in France."[1] However, in spite of discomfort we duly reached the old pirate stronghold, which, up to the time of its bombardment by English and Dutch ships under Lord Exmouth in 1816, was wont to defy Europe. Algiers still retains much of its former picturesqueness and Oriental character, though these are fast disappearing before French "improvements"; indeed Mustapha, the European residential quarter, might well be on the Riviera.

Butterflies were by no means common, it was evidently too early. On the slopes at the back of the hotel, at about 300 ft. above the sea, several Whites were seen, also a *Gonepteryx* and a *Colias*, but the only butterfly netted was a male *Ganoris rapae*. Flying against a sandy cliff close by was *Macroglossa stellatarum*, which I found afterwards to be one of the commonest Algerine moths. The butterfly that was commonest around Mustapha was the fulvous form of *Pararge aegeria*, Linn. (*meone*, Cram.). This was especially numerous near Koubba, and taking it at the time to be a species new to me especially noted its habits. It flies slowly, and, as a rule, for a short distance, settling on the ground, or on stones, with its wings from three-fourths to four-fifths expanded, and turns round so that its back is to the sun. I never saw one of these butterflies settled more than 45° out of this adjustment. Two specimens had had their wings snipped, perhaps by a would-be captor. It was a source of some

[1] Shortly after this was written—early in 1910—the "Général Chanzy" was wrecked on Minorca, with the loss of all on board.

satisfaction to my insularity that British specimens of *aegeria* are unquestionably more beautiful than Algerine *meone*.

Owing to the scarcity of Lepidoptera I was driven to pay more attention to other orders of insects than is my wont, and of these the Hymenoptera claimed the first place. On or about a sandy cliff by the roadside, some 300 ft. above the sea, I secured two of the solitary wasp *Odynerus* (*Hoplopus*) *consobrinus*, Duf., and with them a female Fossor, *Salius* sp., that the late Mr. Ed. Saunders was unable to name; also a male of the fine *Podalirius dispar*, Lepel. This last I found more commonly at somewhat higher levels, *e.g.* near Birmandreis, *circa* 550 ft., where both male and female were caught hovering. In the same locality a male of *Pararge megaera* turned up.

Beetles were not numerous, they comprised a specimen of the familiar *Chrysomela banksii*, Fabr., near the Colonne Voirol; and an example of *Brachycerus sinuatus*, Oliv., taken by Miss Kennedy on a wall. This weevil has extremely hard integuments so that it must be difficult to masticate and well-nigh impossible to digest. A *Carabus* found crawling on some steps in Mustapha, about 150 ft. above sea-level, does not appear to be represented in the South Kensington collection.

At Birmandreis I took an Acridian, *Epacromia strepens*, Latr., and my daughter took another, *Tryxalis giganteus*, Fuessly. At the same place I found the bug *Enoplops scapha*, Fabr.; also two of the black and yellow Syrphid fly *Chrysotoxum italicum*, Rond. (*intermedium*, Lio. & S.), an obvious mimic of a small wasp.

Guyotville.

February 8th.

I spent a very pleasant day on the sand-dunes of Guyotville, nine miles to the west of Alger, near the terminus of the tramway, but it was too early for very profitable collecting. With *Pararge meone* were several *Ganoris rapae*, and another old friend, *Chrysophanus phlaeas*. A solitary grasshopper put in an appearance—*Pachytylus danicus*, Linn. An ant-lion, *Palpares libelluloides*, Linn., interested me greatly. This insect runs backwards, and buries itself with startling rapidity in the sand which it so closely resembles.

Among the Aculeata were single specimens of two British Fossors—*Philanthus triangulum*, Fabr., and *Pompilus plumbeus*, Fabr., together with a number of *Odynerus consobrinus*, and a small female bee *Sphecodes* sp., while the little *Notogonia nigrita*, Kohl, was taken

flying about sandy banks, and was more than once seen to enter holes therein.

The only beetles that I came across were two *Blaps cognata*, Sol., a female found dead and a male crawling on the sand.

Biskra, lat. 34° 50′ N., altitude 400 ft.

February 16th—March 8th.

Disappointed in the chilliness of Alger, and the lateness of vegetation and insect life, we determined to make without delay for the southernmost hotel in the land. The journey was cold, and at a station on the high central plateau of the Atlas range, which was passed in the night, we were told that the fresh fallen snow was a metre deep. This was, however, quickly forgotten as we passed through the gorge of El Kantara (The Bridge), and the opening view disclosed a grove of date-palms marking the oasis of the same name, and then for the first time we felt the fascination of the desert.

Biskra, now the terminus of the railway, was once an important military outpost connected with civilization by a semaphore telegraph, the towers of which still stand upon prominent heights far above the railway. Set just where the main caravan route across the portion of the Sahara known as the Ziban emerges from the foothills of the Atlas on its way to Tuggurt and Wagla, and ultimately to Timbuktu, it guards the gate of the desert, and the place is interesting in many ways. The old fort, with enceinte sufficiently extensive to contain all the white population, told of the troubled times not long ago (if indeed even now quite of the past), and reminded some of us of the mud fort of Peshâwar, though entirely devoid of its picturesqueness. The market is an important one, and here may be studied to advantage the man-child of the desert in his native dress, a costume that for grace and dignity is probably unequalled. I say "man-child" advisedly, for the women are strictly secluded from the profane gaze of the tourist. Camels seem innumerable; indescribably fascinating in the middle distance as they slowly wend their swinging way across the desert plain, they are at close quarters indescribably hideous and provokingly supercilious. I had the good fortune to see a caravan from Timbuktu the morning after its arrival. Three days before the end of the three months' journey a foal, seemingly the first of the season, had been born, and, being unable to keep up with the caravan, had been strapped upon its mother's back! This foal, longer as to its legs than any foal

of horse or ass, had a surprisingly small body and a quite charming head. When carried in my arms and petted it gave vent to all the grunts and gurglings of its native language, but in a childish treble, and was altogether a most fascinating little beast. Perhaps it differed most from its hideous mother in that it had a new coat of its own, whereas nearly all other camels whose acquaintance I have made seem to wear second-hand clothes, and bad at that.

The spurs of the Aures mountains, themselves a part of the great Atlas range, which shut in the view towards the north with a wall of from 1000 to 2000 ft. in height, backed by higher ridges and peaks ranging to 6700 and even 7700 ft., are for the most part bare and devoid of obvious vegetation, and though brilliant with varied colour—especially under the glow of sunset—suggest the extreme of desolation. A closer inspection, however, reveals a greater number and variety of plants than would have been expected; these are mainly to be found in the small Wâdîs or watercourses (now dry) that score the hillsides. This vegetation spreads to a greater or less extent over the higher portions of the desert, but the year of my visit was an exceptionally dry one, and stretches of land in more favourable seasons carpeted with flowers were then so barren that the Bedawin expected to lose many camels from starvation.

The spring of 1905 was unusually cold throughout the Mediterranean basin, and patches of snow which during the greater part of our stay were to be seen on the higher mountains, naturally cooled down the prevalent north-westerly wind. One morning is firmly impressed on my memory; I left the hotel before 8 a.m. to walk to Fontaine Chaude with the keen blast full in my face; my hands were visibly blue, while I felt assured that nose and ears were of a tint to match, yet at the same time the morning sun beat full upon my back, so that I was grateful for my light sun-helmet. Under such circumstances the strain on the vaso-motor system in its endeavours to maintain the normal temperature of the body must be excessive, its anterior and posterior portions respectively having inconsistent demands made upon them.

The bed of the river was for the most part dry when I saw it. Along its banks runs the Oasis of Biskra, while other oases are visible to the east and south as dark patches on the desert, like islands on a sea. As the sun rises and warms the desert, and the layers of air in contact with it, these dark patches are seen to rise from the earth, and appear to float on the further side of non-existent lakes. *This phenomenon, due to refraction, is well known*

as *mirage;* it is, perhaps, not as well known that, if looked for, it may be seen as far from the Great Sahara as the Southampton Water and the Gulf of the St. Lawrence. It may even be seen on any hot, still day on Woolacombe Sands.

These oases, which point to water at no great depth below the surface, are, and have for ages been, completely cultivated, so that their vegetation is practically confined to date-palms, corn, and other crops with a few weeds of cultivation; the indigenous flora no longer exists to afford pabulum for insects, which are consequently confined to a very limited number of species. The cosmopolitan *Pyrameis cardui* was fairly common; *Chrysophanus phlaeas* was seen once; *Ganoris rapae* and *Colias edusa, auct.,* put in an occasional appearance, the last-named the more frequently; our Mustapha friend *Pararge meone* was occasionally to be met with. A small aromatic Umbellate in a vegetable garden attracted *Odynerus consobrinus*, *Osmia kohlii*, Ducke, an unnamed *Andrena*, and the vulgar fly *Eristalis tenax*, Fabr. In fields of broad-bean both sexes of *Psithyrus fulvitarsis*, Brullé, were common; this bee was also found buzzing about mud walls, together with *Polistes gallicus*, Linn., and a number of *Odynerus consobrinus;* the same bee haunted an earth bank which evidently contained its nests.

Turning over stones in the river-bed not far off brought to light a Scorpion, the apterous Heteromeron *Adesmia faremonti*, Lucas, as well as abundance of the gregarious *Pachychila impressifrons*, Sol., a beetle with an extremely hard exo-skeleton.

In the Chetma Oasis, about five miles to the eastward, a field of cultivated vetch yielded, besides *Apis mellifica*, several specimens of *Podalirius* (?) *ambiguus*, Per. The widely-distributed moths *Nomophila noctuella*, Schiff., and *Plutella maculipennis*, Curtis (*cruciferarum*, Zell.), looked homelike enough, but the beetles on the sand close by—*Pimelia arenaria*, Sol., and *Akis spinosa*, Fabr. (dead)—gave a more exotic tone to the place. The flowers of *Cleome arabica*, Linn., yielded nothing but honey-bees.

In the famous Jardin Landon but very few additional species occurred. The common Cricket *Gryllus domesticus*, Linn., was found upon a path where the Ant *Myrmecocystus viaticus*, Fabr., was busily at work. The lawns provided food and shelter for a few Acridians, such as *Acrotylus patruelis*, Sturm., *Stenobothrus bicolor*, Charp., *Epacromia strepens*, *E. thalassina*, Fabr., and the Tryxalid,

Lepel., the huge Grasshopper *Acridium aegyptiacum*, Linn., and a Fly of the genus *Sarcophaga*.

In the north-western outskirts of the town a rough grassy place adjoining the "Tir-à-pigeons," in the Beni Mora Oasis, was (when the mountain wind was not too strong) somewhat more productive. Here the characteristic Butterfly was *Euchloë belemia*, Esp., which on March 8th was not uncommon though not easy to catch. An odd specimen had occurred in the Jardin Landon four days before. Two Aculeates were captured, *Colletes coriandri*, Per., and *Notogonia nigrita*; a Fly very near to *Tachina marklini*, Zett.; the Acridian *Stenobothrus bicolor*, and the Bug *Lygaeus pandurus*, the latter taken on the wing. Close by I disturbed what I feel sure must have been *Macroglossa stellatarum*.

As regards the desert itself, as might have been expected, the more stony and wind-swept portions proved the least productive; thus the foothills to the north-east yielded no Lepidoptera at all, though I have a hazy recollection of having on one occasion seen what was probably *P. cardui*. But even in the parts that were comparatively prolific, Lepidoptera were so scarce at the time of my visit that I was driven to collecting Hymenoptera and Coleoptera to occupy my time. Yet even with these it was not always easy to fill my boxes.

The long-legged, apterous Heteromeron *Adesmia biskarensis*, Lucas, was rather common, looking not unlike a spider as it ran rapidly over the sand. On my first walk the only creature on the wing appeared to be *Podalirius crinipes*, Smith, of which the female might often be *heard* as it hovered over the flowers of the "Qedad," or Camel-grass (*Acanthyllis tragacanthoides*, Pom.). It proved, however, hard to localize the sound, and therefore not easy to see the bee; moreover, it was decidedly difficult to catch, so that it took some time to secure four specimens. The same day I caught upon my coat that strange fly *Hippobosca camelina*, Leach; possibly in the desert, where food is scarce, man may be almost as great a delicacy as camel. These same foothills yielded a week later a couple of *Adesmia acervata*, Klug, running on the ground; also *Eristalis tenax*, though assuredly there are no drains on those arid slopes.

HAMMAM-ES-SALAHIN, called by the French "Fontaine Chaude," lies some four miles to the north-east of Biskra, nestling close under the mountains at the head of, as it were, a bay of desert. It is known to entomologists as the place where Lord Walsingham stayed for several months, engaged for the most part, in studying the *Tineina* of the locality. His lordship's fame as a collector, a skilful

shooter of ducks, but, above all, a mighty walker, seemed to haunt the place, and I had the advantage of visiting it with his Bedawin assistant, who seemed to be a born naturalist. Suleiman bin Arbi (if I have his name aright) is tall, distinguished-looking, of soft and gentle voice, speaking French, if not with fluency, at least with an elegance that I could not but envy. He seemed to know where every creature lived, and what it fed upon; in many cases he knew its Latin name. To see him turn over a stone, pluck a grass-stem, thrust it into a hole in the ground and presently extract a large spider, was an education. He told me proudly that the Bedawin knew where to find water in the desert, adding with contempt in his voice that the Frenchman did not.

There was a certain amount of vegetation about the stream leading from the sulphur spring, there was also vegetation of a sort in the dry gullies on the mountain-sides, gullies which had all the appearance of occasionally functioning as watercourses. Here I found, at the end of February or beginning of March, an Umbelliferous plant bearing small lumps of a gummy exudation; these proved to be the abode of larvae from which I bred on April 12th and May 3rd two specimens of *Agonopteryx* (*Depressaria*) *thapsiella*, Zell.

Stone turning was not as profitable as might have been expected, perhaps because there were too many stones. I had got into the habit of catching beetles with my fingers, but was rebuked by Suleiman who said that it was not safe to dispense with forceps. Pondering over this remark I turned three stones in succession with this result:—(1) A most formidable looking Spider, alleged to be deadly; (2) A large Scorpion; (3) A small horned Viper, or Asp (*Cerastes cornutus*)! After the last I took to my forceps and used them assiduously. The danger, such as it is, consists in the way that animals lurk in the loose sand or vegetable debris under the stones. Of less deadly seekers after shade I found *Opatrum rusticum*, Oliv.; *Microtelus cariniceps*, Reichs.; *Aphodius granarius*, Linn.; *Nephodes* sp.; *Micipsa* sp.; *Helops* sp.; none of the three last being represented in the National Collection. Other Coleoptera met with were *Blaps prodigiosa*, Erichs.; *Pimelia simplex*, Sol.; and *P. latreillei*, Sol.; this last again being unrepresented at South Kensington; *Adesmia faremonti*, one; *A. acervata*, one; *A. biskarensis*, commonly. Of *Scarabaeus puncticollis*, Latr., two were picked up off the sand, and one taken on the wing. On one occasion my daughter heard a slight rustling noise proceeding from a clump of Zaïta (*Limoniastrum guyonianum*, Coss.), she watched carefully and soon saw the pretty beetle *Graphipterus multiguttatus*, Oliv.,

run out on to the open and heard it make the stridulating noise characteristic of the genus, she then saw the handsome big Carabid *Anthia sex-maculata*, Fabr., running about in the middle of the little bush. Query, was the big Carnivore in pursuit of the lesser? The *Graphipterus*, which is fairly common about Biskra, has quite soft integuments. It courses over the sand with surprising rapidity, and its broken coloration, a neat pattern of black and white, makes it remarkably inconspicuous; it is apterous; when pursued it often conceals itself under stones, or among the roots of plants or buries itself (like *Zophosis*) rapidly in the sand. The big *Anthia*, a much less common insect, is also exceedingly swift of foot; it too is black and white, but of such ferocious aspect that I nicknamed it the Hyaena beetle. Presumably it is the master beast of all insects in those parts, as perhaps it is the swiftest of foot.

I learned from Suleiman that the flowers of the fine Orobanchid parasite, *Phelypaea violacea*, Desf., are infested with a small Weevil, a species of *Baridius*. The same keen-eyed collector pointed out the fine large Mantid *Blepharopsis mendica*, Fabr., which was quite inconspicuous as it sat upon a glaucous green desert plant. Its elytra are decorated with a grey-green pattern strangely like certain cheap wall-papers. Only two other members of the Orthoptera were met with, viz. *Euprepocnemis plorans*, and *Pamphagus algericus*, Brunn., the latter some little height up the mountain, where also, in an absolutely waterless ravine the Dragon-fly *Lestes sponsa*, Hansem., seemed somewhat out of place, but it had probably gone there a-hunting, since others of the same species, together with *Micronympha elegans*, Lind., were taken by Suleiman along the stream which flows from the hot sulphur spring. *Gonia capitata*, De Geer, was the only fly that I brought away, but the Aculeata were represented by a couple of female *Podalirius crinipes*, and a male *Osmia latreillei*, Spin., as well as several *Apis mellifica*. In addition to these were two species of ant, one, *Myrmecocystus viaticus*, of which a worker was seen carrying with the greatest ease an apparently impossible load; the other, the glistening *M. bombycinus*, Rog., with its thorax and abdomen seemingly electro-plated. My daughter and I were interested in watching the workers of this very agile ant engaged in excavating, or at least in removing, sand from the mouth of the nest; the sand was shifted but a very short distance by an excessively rapid movement of the hind-legs. While this was going on a "soldier" appeared, thrust out his head, as if to reconnoitre, and then withdrew, perhaps to report our presence.

I visited Hammam-es-Salahin three times; on the last occasion

(March 3rd) the weather was unfavourable and no butterflies were seen. Suleiman showed me the locality for *Teracolus nouna*, Lucas, but said it was too early for it. On Feb. 27th and 28th I was more fortunate and took a specimen of *Euchloë belledice*, Hübn. (*belia*, Cram.), three of *E. belemia* and five of *E. charlonia*, Donz. The last-named, Dr. Dixey says, is probably identical with *E. lavaillanti*, Lucas. My specimens were all males. With the Pierines was a very small, worn Painted Lady. All these butterflies were taken on sandy hillocks near the baths, with the exception of one *E. belemia* which I came across in one of the mountain gullies. The *Euchloë* all flew swiftly and were by no means conspicuous as they coursed over the light-coloured sand. Both *charlonia* and *belemia* sat in their pill-boxes in a remarkable attitude, their fore-wings drawn back so far within the hind-wings that the costa of the hind-wing actually projected beyond the costa of the fore-wing. As a consequence every scrap of white or yellow on the underside of the fore-wings was concealed by the highly cryptic hind-wings, which are of an almost uniform green in *charlonia*, of a striped green and white in *belemia*. But in addition to this the abdomen is much raised so as to be held almost erect between the hind-wings, which in turn are held far from the object on which the butterfly sits, thus greatly increasing the resemblance in form as well as colour of the whole butterfly to a leaf. [See Plate V. Fig. 10.] Unfortunately I did not see either butterfly resting in natural conditions. On one of my visits Suleiman brought me an example of the cosmopolitan *Nomophila noctuella*.

Another favourite collecting ground of mine lay some three miles to the west of the town, just north of the Route des Zibans, where a low ridge of hills has led to considerable accumulations of sand. The scanty vegetation of these slopes, and the ground between them and the road, was prolific in typically desert insects.

The first creatures to catch the eye were the heavy black Heteromerous Beetles of the genus *Pimelia*, whose curious tracks made a sort of embroidery over the smooth sand. Here and there the insects themselves might be seen journeying at a fair pace over the ground, succeeding in a surprising manner in ascending even steep slopes of dry running sand. Among many *P. consobrina*, Lucas, some of which were seen to bury themselves, was one of another species which Mr. Arrow considers to be near to, but not identical with, *P. senegalensis*, Oliv. The beetles of this genus are phytophagous in habit and several times I saw them climbing up and eating the petals of *Retama retam*, Webb. Suleiman told me

that they eat the *Euphorbia guyoniana*, Bois. Reut., down to the ground; on the same plant he said that later in the year might be found *"des chenilles avec cornes et des tâches rougâtres"*—evidently *Deilephila euphorbiae*, Linn. I did indeed dig out of the sand two brown Sphinx pupae, but unfortunately they dried up and the moths never emerged.

A smaller Heteromeron, *Erodius bicostatus*, Sol., might be seen occasionally crawling on the sand, whereas *Zophosis approximata*, Deyr., ran with great rapidity. Both these species were to be obtained in greater numbers by scratching the sand away from the roots of the Zaïta. The *Zophosis* is covered with a (?) waxy substance, exactly the colour of the sand, easily rubbed off by the fingers, or in the killing bottle, leaving the beetle black and shining. Any one familiar with cabinet specimens only would be surprised to hear that it is a very cryptic insect. Among my specimens of *Erodius* Mr. Arrow found one, if not two, species unrepresented in the National Collection. Another beetle found on the sand, or at the roots of Zaïta, was a black *Tentyria*. Single specimens of the pretty *Graphipterus multiguttatus* and the formidable *Anthia sexmaculata* were secured. Other beetles found were *Sepidium requieni*, Sol., and *Cleonus* sp., the latter a Weevil just the colour of the sand and further protected by its stony-hard integuments. Once I followed some tracks over the sand for several yards, and where they ceased found *Scarabaeus puncticollis*, buried about an inch and a half below the surface. On the Spurge, *Euphorbia guyoniana*, our garden friend *Coccinella 7-punctata*, Linn., was conspicuous.

Of Bugs I found but two species, a *Menaccarus* allied to *hirticornis*, Puton, on the sand under a *Retama* bush, and *Lygaeus pandurus* on *Euphorbia*.

I took but few Diptera, those mostly at the Spurge flowers, viz. *Rhyncomyia* sp., two males of a species not in the British Museum; one *Musca vitripennis*, Meig.; and a male *Tachina* allied to *marklini*. Lastly a specimen of *Hippobosca camelina* was, after settling three times on my coat, finally secured.

The Aculeata were somewhat more plentiful. Ants were represented by the silvered *Myrmecocystus bombycinus* running with quite remarkable swiftness over the sand, together with the less distinguished-looking *Camponotus maculatus*, Fabr. The flowers of the Spurge yielded males of *Andrena lepeletieri*, Lucas, and *A. ephippium*, Spin., as well as several *Apis mellifica*. The sweet-smelling white flowers of the desert Broom, *Retama retam*, were more productive, the honey-gatherers including *Andrena albofasciata*, Thunb., a female;

A. nigroaenea, Kirby; several specimens of *Colletes coriandri*; three *Chalicodoma nasidens*, Latr.; four *C. sicula*, Rossi, and two of another *Chalicodoma* to which the late Mr. Ed. Saunders failed to assign a name. Besides these there were on the *Retama* blossoms solitary males of *Dioxys chalicoda*, Lucas, and *Podalirius calcaratus*, Lepel., and I found, settled on the sand, a male of the Fossor *Notogonia argyropyga*, Kohl.

It was at the foot of these sandhills that I took a single *Melitaea didyma*, Esp., f. *deserticola*, Oberth., flying rapidly yet suggesting a small *Acraea*. Here also a thin whip-like, sand-coloured Snake some two feet long came *towards* me with a darting motion. It is the only time that I have seen a snake approach me, perhaps, however, I got between the reptile and its abode. After a hot chase it disappeared down a hole under a large plant of *Limoniastrum*. A Biskra dealer in curiosities, who seemed to be somewhat of a naturalist, declared that these snakes fly through the air "*comme une flèche*," and certainly my animal gave quite that impression.

Another sandy region, locally known as The Dunes, affords a good collecting ground. It lies about five miles south-south-west of Biskra on the Oumache road. Here, where sheets and ridges of loose sand alternate with tufts of vegetation, the following Beetles turned up: *Graphipterus multiguttatus*, three captured by Mr. R. T. Ussher, also two by myself at the roots of *Limoniastrum*, together with a specimen of *Erodius elegans*, Kra.; *Adesmia faremonti*, one taken by Mr. Ussher; *Zophosis approximata*; *Erodius bicostatus*, three; *Cleonus hieroglyphicus*, Oliv., and *Sepidium requieni*, the last three all found at the foot of slopes of running sand which they were unable to climb. The exo-skeleton of the *Cleonus* turned the points of several pins! The Cetoniid *Oxythyrea stictica*, Linn., together with *Tentyria* sp., occurred on the flowers of the Spurge. Suleiman found on the bare sand two *Scarabaeus puncticollis* and one *Anthia sex-maculata*.

At the foot of a clump of rushes growing on the sand I found a populous nest of the electro-plated *Myrmecocystus bombycinus*. The most attractive flowers were those of the *Euphorbia guyoniana* which yielded, besides Honey-bees and numerous 7-spot Ladybirds, the Bugs, *Lygaeus pandurus* and *Brachypelta aterrima*, Forster; the Flies, *Syrphus corollae*, Fabr., and *Catabomba albomaculata*, Macq. With these were the following Bees: *Andrena ephippium*, two females; *A. nigroaenea*, with its var. *nigrosericea*; a stylopized specimen of *A. rosae*, Panz., var. *trimmerana*, Kirby; *Colletes coriandri*, and *Halictus* (?) *malachurus*, Kirby, a female.

On March 1st I went by rail to El Outaia, some ten miles north

of Biskra, and collected in the dry valleys, locally termed Oueds, or Wâdis. Here I saw *Pyrameis cardui*, four specimens of *Colias edusa*, and a single example of the neat little *Melitaea didyma*. On the earthy cliffs of the Oued the Tiger-beetle, *Cicindela flexuosa*, Fabr., and the Ant *Myrmecocystus viaticus* were hawking about, while the brilliant *Chrysis ignita*, Linn., was searching, I suppose, for nests of *Eumenes*. A *Pimelia simplex* was picked up from the ground and when killed exuded much fluid by the mouth. There were also found on the ground *Adesmia faremonti*, and a female *A. biskarensis*, as well as the evil-smelling Bug *Lygaeus fulvipes*, Dallas, the last-named found by my daughter. The best collecting, however, was furnished by a large plant, almost a bush, of a species of *Spergula*. On or about its flowers were numbers of Bees, to wit: *Colletes coriandri*, in abundance; *C. braccatus*, Per., two; *C. acutus*, Per., one; *Andrena lepeletieri*, a male; *A. nigro-aenea*, two; also two other male *Andrenae*, to which Mr. Saunders could not assign names; *Osmia submicans*, Mor., a male; *Eucera algira*, Lepel., a male; *Podalirius atriceps*, Per., and *P.* (?) *ambiguus*, one of each. Together with these was the Dipteron *Catabomba albomaculata*. There were also some very wary Wasps which I thought might be mimicked by this Syrphid, but I failed to secure any of them.

It was at Biskra that I made my first acquaintance with the Desert, and was much impressed, as no naturalist can fail to be, with the severity of the struggle for existence thereon. To begin with, plants live under most adverse conditions, more especially as the prevailing lack of moisture is from time to time intensified by periods of exceptional drought. It was during such a period that I visited Biskra; as an obvious result of the drought extensive regions near the town, which gave evidence of having been cultivated in more favourable seasons, were then absolutely bare. My Bedawin assistant told me as we gazed over the desert from a lofty sandhill near the sulphur spring, that in ordinary years, where we then saw little save sand and stones, the prospect was "all flowers." Such vegetation as did meet the eye was much of it strange, often succulent, often protected by thorns or spines, notably the Qedad or Camel-grass, a plant that no European mammal would attempt to eat. There was an Umbellifer with all the appearance of a Rush, another was possibly protected by its odour, but the milky-juice of the prevalent *Euphorbia* seemed to give it alone among plants an immunity from the attacks of camels and goats, though not from *Deilephila*. Perhaps the most showy plant on the desert was the parasitic *Phelypaea violacea*, Desf. (*Orobanchaceae*).

My scientific Bedawin pointed out to me the tracks on the sand of the Hare, the Jackal, the Jerboa, and the fine Indian Houbara Bustard[1] (*Otis macqueeni*, E. Gray). But it was much easier to track smaller game, such as the *Pimelia* and other beetles, (?) *Agrotis* larvae, and above all Lizards. The latter usually let their tails drag along the ground leaving a continuous line on the sand between the footprints, but when alarmed the creatures raise their tails aloft, seeming thereby to get greater freedom of movement. Thus a lizard trail consistiug of foot-marks only is clear proof of "full speed ahead," which in the case of a desert lizard means a very notable pace. I have spoken previously of the rapid gait of *Adesmia*, *Graphipterus* and *Anthia*. In marked contrast to these are the heavy movements of *Pimelia* and *Erodius*, though they are very conspicuous. The big black Pimelias are often found with dents on their elytra; do these indicate attacks by birds? That they are somewhat protected is suggested as well by their habits as by the fact that dead specimens, entire, but cleaned out by ants, are frequently met with; such are usually of a brown tint. The beetles of the genera *Pachychila* and *Cleonus* must be well protected by their hard integuments, but the latter are in addition cryptically coloured.

Dr. G. R. Crotch's opinion that the large wingless Heteromera so abundant in the Canary Islands are actually protected by their inability to fly has been already mentioned.[2] Here I found allied beetles very numerous on the outskirts of the Sahara. Could a like line of argument be reasonably followed here? Could it be maintained that if endowed with wings these beetles would have run serious risks of being lost in the desert? I should be sorry to have to maintain that view. It would, however, seem to be a fact that the loss of wings by restricting locomotion has favoured the development of a great number of closely allied species inhabiting very restricted localities.

But Beetles are not the only swift-footed desert insects; the Ant *Myrmecocystus bombycinus* is remarkably quick in its movements, even for an ant. Indeed the state of habitual terror in which the denizens of the desert seem to live, sometimes quite "got on my nerves," as the saying is.

Among Birds the Desert Wheatear—*Saxicola deserti*, Temm., is a well-known instance of cryptic coloration. Seen from the side, as when, sitting on the ground, one looks at the bird perched on a

[1] By the kindness of Mr. R. T. Ussher I was enabled to try my first experiment in bird-skinning on a specimen of this bird.

[2] See above, p. 26.

small sandhill or bush, it appears to be somewhat brilliantly coloured, having its neck and side of the head, as well as the lower edge of the folded wing, black, with a red-brown head and pale belly. But, on the other hand, when seen from above, as a hovering hawk would look at it, its reddish head and back are scarcely distinguishable from the sand.

The cryptic habits of the two Butterflies *Euchloë belemia* and *E. charlonia* have been already described [see p. 162].

Lastly, the Mantid *Blepharopsis,* referred to above, is one of the most striking examples of protective resemblance that I have come across.

HAMMAM MESKUTINE, lat. 36° 25′ N. *circa* 1000 ft. above sea-level.

March 11th—16th, 1905.

Our stay at CONSTANTINE was so short as to allow but a hurried walk through its fearsome gorge—where, by the way, *Colias edusa* was coursing up and down the slopes. It was almost heart-rending to see how far French "improvements" have marred the beauty of perhaps the most picturesquely situated city in Africa. From Constantine we went to the wonderful hot springs of MESKUTINE. The hotel people were charming, so was Mdlle. Antoinette, the tame Wild-Boar, though she *was* somewhat addicted to gnawing portmanteaux until driven away by a ridiculously small terrier.

Here, by the way, Wild-Boars are very common, and work much destruction, so that one realized the meaning of the Psalmist's words: "The wild-boar out of the wood doth root it up." Doubtless their abundance is owing to the Moslem religion forbidding the native inhabitants to eat their flesh.

My collecting ground on the hillside above the sulphur springs differed in almost every respect from that at Biskra, accordingly nearly every insect taken was different, and of almost European aspect. Butterflies were fairly common, most of them—*Ganoris rapae, Colias edusa, Pararge megaera, Coenonympha pamphilus,* and even *Vanessa polychloros,* were homelike enough, but far more conspicuous than any of these was that grand insect *Gonepteryx cleopatra,* Linn., which was quite common. Then there was *Euchloë belledice,* and another butterfly quite new to me, *Thestor ballus,* Fabr., was fairly common. This last with its green underside was hard to see on the wing, still harder to see when settled, the black spots on the fore-wing being completely concealed in the attitude of rest.

Among Moths the biggest was a male *Saturnia atlantica*, Lucas, found in the hotel; the smallest was an old friend, *Plutella maculipennis*. Another old friend, *Caradrina quadripunctata*, Fabr. (*cubicularis*, Bork.) came to light. *Chesias oranaria*, Lucas, was found among low plants, and *Scoparia angustea*, Steph., was beaten out of a hedge of *Pistacia lentiscus*, Linn.

Near the interesting ruined Roman city of ANNOUNA my daughter found the apterous female of *Ocnogyna gandolphei*, Oberth.

Diptera were represented by *Bombylius boghariensis*, Macq., taken on the hillside hovering near the ground, *Eristalis tenax* and *Calliphora erythrocephala*, Meig., together with *Syrphus* sp., which was found in some numbers in company with *Apis mellifica*, at the green flowers of a Buckthorn, *Rhamnus alaternus*, Linn.

A community of the Ant, *Camponotus sichelii*, Mayr, was found under a stone, and one of *Aphaenogaster sardoa*, Mayr, under another, while *A. barbara*, Linn., took the place of the latter at Announa. Sweeping yielded *Andrena minutata*, Kirby, *Halictus* (?) *malachurus*, and a Fly *Spilogaster* sp. The *leaves* of some large Agaves near the hotel appeared to be attractive, and among other insects I took on them a male of *Osmia latreillei*. There is, I think, little doubt that insects, more especially Diptera, are fond of sitting on large leaves, probably to sun themselves. Thus I have often noticed Syrphids sitting on the leaves of Rhododendrons and Hydrangeas in my garden at Mortehoe.

The most conspicuous Aculeates were the large Carpenter-bees, of which by far the commonest was *Xylocopa violacea*, Linn., occurring on the flowers of *Prunus* sp., of *Cineraria* sp., and on *Agave* leaves, but of *X. cyanea*, Smith, one example only was secured. Of *Andrena viridata*, Per., I took a single male, but *A. lucens*, Imh., was rather common. At the flowers of Horehound, *Cynoglossum cheirifolium*, Linn., I took a male of *Podalirius pilipes*, Fabr., var., while *P. dispar*, was to be had on the same flowers as well as on those of Asphodel. A female of *P. dispar* had two, a *X. violacea* had four pollinia on its head, but whether of *Orchis* or *Asclepias* I cannot now say. A female of *Bombus terrestris*, Linn., taken at *Cynoglossum* flowers, was the first of the genus that I met with in Algeria. The Fossors *Notogonia nigrita*, and a female *Salius*, were seen about cliffs of alluvium and tufa respectively.

Here I may remark that I have often noticed that *Xylocopae* and *Bombi* are more quickly knocked down and killed by cyanide than are *Noctuae*, or even quite small beetles.

I met with very few Orthoptera at Hammam Meskutine, only the

Cockroach, *Loboptera* (?) *decipiens*, Germ., and the Grasshopper,[1] *Acridium aegyptiacum*, which flew from tree to tree. Very few Beetles turned up; *Copris hispanus*, Linn., a female; *Geotrupes hypocrita*, Serv.; *Asida elevata*, Chev.; and *Scaurus atratus*, Fabr., the last two found under stones together with two larvae of a *Lampyris*.[2]

Here for the first time in Algeria I came across Tortoises; two specimens measured 4¾ and 5½ inches respectively. Here also I found a small Crab under a stone near a stream, but over 30 miles from the sea.

During the beautiful drive from Sétif to Bougie through the mountains of Kabylia, by way of the Gorge de Chabet, I saw but few insects. In the higher parts of the road, 1800—2700 ft., I netted *Pyrameis cardui*, and a couple of *Vanessa polychloros*. In the dismal gorge itself the flowers of a shrub of Laurustinus (*Viburnum tinus*, Linn.), apparently wild, attracted several *Cyaniris argiolus*, Linn., as well as the Drone-fly, *Eristalis tenax*. At Rosemary I was disappointed in seeing nothing but Honey-bees.

* * * * *

Strange; at this point I laid aside my pen and took up that delightful book, "The Household of Sir Thomas More," where presently I came across this passage: "As for Rofemarie, I lett it run alle over my Garden Walls, not onlie because my Bees love it, but becaufe 'tis the Herb facred to Remembrance. . . ."

* * * * *

Below the gorge, at about 500 ft. above sea-level, there were more insects, but no great variety; *Colias edusa*, males only; *Coenonympha pamphilus*; *Coccinella 7-punctata*; *Aphodius prodromus*, Brahm.; a stylopized *Andrena* sp.; a Tipulid fly, *Pachyrrhina* sp.; *Bombylius variabilis*, Loew, and the Ant *Aphaenogaster barbara*.

Near Cape Okas insects were more numerous. *Gonepteryx cleopatra* was fairly abundant, and a couple of *G. rhamni* were netted; the only other butterflies were a pair of *Ganoris rapae*, and a solitary *Pararge aegeria*, var. *meone*. This last was twice seen to settle with its wings up and tail to the sun; it was thus very inconspicuous, casting no shadow. A specimen of *Acridium aegyptiacum* was secured, not always an easy matter.

[1] This large grasshopper would certainly by most travellers be called a "Locust"; so with the typical migratory locusts, *Schistocerca peregrina* and *Acridium pardalinum*, but, by a most unhappy confusion of nomenclature, none of them are *Locustidae*, but all belong to the *Acridiidae*.

[2] This is not *L. noctiluca*, Linn., but there are unnamed specimens of the same larva in the British Museum.

One of the most obvious insects was the small Chafer, *Tropinota hirtella*, Linn., of which numbers were flying about, or settled on, flowers, especially favouring those of *Fedia decipiens*, Pomel. They greatly resembled bees on the wing. There was also a fair number of Wasps and Bees. Among the former *Polistes gallicus* was prominent. I here took two males of *Podalirius dispar*, also four males of a species of *Eucera* to which Mr. Saunders failed to assign a name. The vast genus *Andrena* was represented by *nigroaenea*, and two unnamed males, while *Apis mellifica* put in an appearance as usual. There was in addition an unnamed Sawfly, while Diptera were represented by *Bombylius bogharensis* and *Melanostoma* (?) *mellinum*, Linn.

Bougie we thought the prettiest place that we visited in Algeria; the view over the blue waters of the bay towards the snow-clad peaks of Kabylia reminded us of a Swiss or Italian lake. Unfortunately we were able to stop but one night. A short walk the next morning gave the impression that the entomological attractions of Bougie might prove equal to its artistic merits. The following were met with: *Lycaena icarus*, Rott., a male; *Ganoris brassicae; Synchloë daplidice*, Linn., one; *Euchloë belemia*, one; and *E. belia*, Linn. (*eupheno*, Linn.), four males. Naturally I was much excited on taking such a pretty butterfly as *belia* for the first time; it was evidently just emerging and promised to be abundant.

The Bee *Anthidium siculum*, Spin., had a strangely red look upon the wing; with it were *Podalirius dispar*, a male; *Osmia coerulescens*, Latr., a female; and *Odynerus* (*Ancestrocerus*) *parietum*, Linn.; while *Tropinota hirtella* was again successful in passing itself off as a Bee. I also took *Bombylius variabilis*, and the Grasshopper *Thelpomena algeriana*, Lucas.

Hammam R'ihra, or Righa,[1] 1850 ft. above sea-level.

March 20th—31st, 1905.

Going by rail from Alger I took during a short stoppage at Blidah a male of *Psithyrus fulvitarsis* and a *Nomada* near to *furva*, Panz., also, on flowers of *Reseda*, the Chafer *Tropinota hirtella*. At Bou Medfa station (800 ft.), whence I walked to the hotel, I took several Aculeates—*Eucera nigrilabris*, Per., with pollinia on its head, *Polistes gallicus*, and *Apis mellifica*, as well as the Fly *Bombylius*

[1] The apparent discrepancy is due to the Arabic letter "Ghäin," which is usually transliterated "Gh," but sometimes "Kh"; it is a guttural consonant somewhat like the Northumbrian "R," or the French "R-grasseyé."

bogharienensis. Close to the station, and indeed all the way up, I found *Euchloë belemia* plentiful. At about 1000 ft. I took single examples of *Eucera trivittata*, Brullé, *Andrena albofasciata*, a male, and *Nomada cirtana*, Per. (? var.), also a male. At about 1200 ft. I took my first *Thais rumina*, Linn., and was greatly delighted thereat. A little higher was *Thestor ballus*.

Hammam R'ihra stands on a hillside looking across a valley; below and to the left are vineyards, to the right a piece of rough ground (good for botanizing) leading to the Forêt de Chaïba (chiefly pines), which culminates in the peak of Mont Samsam, 2800 ft.

The dead, bleached spires of the Land-shell *Bulimus* (*Rumina*) *decollatus*, Linn., were conspicuous on every side.

Butterflies were fairly plentiful, quite plentiful during the latter days of my stay. Satyrines were scarcely common. Of *Pararge meone* I saw a fair number, but only one of *P. megaera*, and that on March 30th—it was perhaps only just coming out at that elevation; of *Coenonympha pamphilus* I got but two. There were several *Pyrameis cardui* about, the first fresh specimen being seen on March 25th. The *Lycaenidae* were somewhat poorly represented by a solitary male *Cyaniris argiolus*, and by the two species of *Thestor*; of these *T. ballus* was common enough, and I took eight males and five females, whereas of *T. mauretanicus*, Lucas, I secured but one male and three females; it appeared to be local, frequenting the edge of the forest, moreover it was hard to see. The dominant group was unquestionably the Pierines. The only Common White was *Ganoris brassicae*. Two of these were in no way remarkable, but the third was unique in my experience—fluttering about flowers near the ground, quite unable to fly away; I found that it had been almost done to death by a bird, nearly the whole of the hind-wings and three-fourths of the fore-wings were gone. Of *Colias edusa* I took but one of each sex. If the *Pierinae* were the dominant group, assuredly *Euchloë* was the dominant genus; *E. belemia* and *E. belledice* were both common enough, but towards the end of my stay *E. belia* (*eupheno*) was far commoner than either, indeed quite abundant, so that I secured a beautiful fresh series of this brilliant Orange-tip, comprising ten males and eight females; the females emerged from four to six days later than the males. In one specimen, a female, there was a sharply-cut notch in the hind-wings, larger in one than in the other; this I took to be the work of a bird.

The gorgeous *Gonepteryx cleopatra* was quite common, the less gaudy *G. rhamni* scarcely less so. I satisfied myself of the very remarkable fact that all the males of *cleopatra* examined (15) had

a distinct, or fairly strong, rich, sweet scent, which I compared to that of Freesia—some lady friends compared it to that of Gorse, Syringa, or Primrose; on the other hand, in ten males of *rhamni* examined there was either no scent to be detected, or something very faint and unlike Freesia. Such a marked physiological difference between two forms by many regarded as conspecific is very remarkable and needs further investigation.

Thais rumina was common just before I left, it appeared to be but little attracted by flowers. No two were quite alike, the scarlet markings being especially variable.

I saw two or three *Papilio podalirius*, Linn., before March 26th, but by the 29th it was fairly common. This magnificent butterfly was most easily secured at the flowers of Hawthorn or Pear, the latter proving to be especially attractive to it.

On some evenings the electric lights at the hotel entrance attracted a considerable number and variety of moths. Of *Zygaena ludicra*, Lucas, and *Lymantria atlantica*, Ramb., I got but one each; of *Hemerophila abruptaria*, Thunb., three; *Idaea virgularia*, Hübn., two; *I. marginepunctata*, Göze, one; *Melanippe fluctuata*, Linn., one; five specimens of a Larentiid, (?) *Cidaria* sp., which does not appear to be represented at South Kensington; *Eupithecia pumilata*, Hübn., one; *E. innotata*, Hübn., three; a specimen of a Boarmiid not in the National Collection; *Cirphis albipuncta*, Fabr., one; *Caradrina quadripunctata*, two; *Agrotis puta*, Hübn., one; *Euxoa* (?) *nigricans*, Linn., one; *Laphygma exigua*, Hübn., one; *Noctua C-nigrum*, Linn., one; *Cloantha polyodon*, Clerck (*perspicillaris*, Linn.), one; *Calophasia platyptera*, Esp., one; *Cucullia chamomillae*, Denis, three; *Xylocampa areola*, Esp. (*lithorrhiza*, Bork.), one; *Thalpochares* (*Micra*) *ostrina*, Hübn., one; *Plusia gamma*, Linn., four; the Quadrifid, *Apopestes cataphanes*, Hübn., two; *Scoparia angustea*, two; the Phycid, *Acrobasis obliqua*, Zell., three; and the Tineid, *Anesychia bipunctella*, Fabr., two.

The following moths were found by day:—*Aspilates ochrearia*, Rossi (*citraria*, Hübn.), one kicked up; *Plusia gamma* at flowers; *Scopula ferrugalis*, Schiff., one disturbed; *Zygaena ludicra* at flowers of Asphodel; *Nemophora pilella*, Schiff. & D. in the pine wood.

Along the winding roads through the Forêt de Chaïba the webs of the larvae of *Cnethocampa processionea*, Linn., were much in evidence, and the larvae themselves were often seen marching across the track. One such procession was carefully observed. The column consisted of 121 larvae marching in Indian file; they formed a waving line across the road, the small deviations from the straight

line being apparently determined by obstacles encountered. There were about ten caterpillars to the foot, so that the column covered twelve feet of ground. Three times I moved the leader from the van to the rear, but this seemed to make no difference, the column went on unperturbed. If a larva were taken out of the middle the ranks very soon closed up. Larvae taken from the ranks and placed *near* the tail of the column failed to find it, unless placed *very close* to it. They travelled with the head of one touching the tail of the next ahead, and they appear to march along a thread of silk. Presumably this thread is laid down by the leader, but I failed to assure myself of this.

Next to the Lepidoptera in importance, so far as my collection was concerned, stood the Hymenoptera. To begin with the humble but industrious ants: of these five species occurred—*Aphaenogaster testaceo-pilosa*, Lucas, of which a colony was found under a stone in the fir-wood; they were remarkably shy of light; and *A. barbara*, big black fellows which were also very shy, and in that respect contrasted with the small yellow *Tetramorium caespitum*, Linn., which had a colony under the same stone. At the summit of Mont Samsam (2800 ft.) I found under stones communities of *Monomorium salomonis*, Linn., and *Camponotus cruentatus*, Latr., the last-named being remarkably sluggish in its movements.

The only Scoliid was *Dielis ciliata*, Fabr., which was very abundant in two spots, a bank between the hotels, and a vineyard south of the hotel, towards Vesoul, at an altitude of about 1600 ft. This insect has tough integuments; it flies close to the ground among the *Calendula algeriensis*, Bois. Reut., and *C. arvensis*, Linn. The bright orange-blossoms of these small Marigolds are quite a feature of Algeria—till the evil season when the vineyards are hoed. *D. ciliata* was also taken at the yellow flowers of the wild *Jasminum fruticans*, Linn. It is curious that I came across no *Pompilus* nor *Eumenes* at Hammam R'ihra, but of *Odynerus* I got two: *O.* (*Hoplopus*) *consobrinus* and one *O.* (*Ancestrocerus*) *parietum*, the last at Hawthorn blossom. The true Wasps were two *Polistes gallicus* and a female *Vespa germanica*, Fabr., the latter found in the forest. Of *Halictus* I took several:—*H. ochraceo-vittatus*, Dours., one; *H.* (?) *malachurus*, two females; *Halictus* sp., one; *H.* (?) *costulatus*, Kriech, one (though Mr. Saunders thought this might possibly be new); also *Halictus* near to *villosulus*, Smith, one. Naturally enough there were several species of *Andrena*; of *A. minutula*, Kirby, which thoroughly deserves its name, I got seven; of *A. sardoa*, Lepel., one; of *Andrena* sp., one; of *A. flavipes*, Panz., as many as thirteen, of these one was taken by Miss M. J. Donald on

Asphodel, but the majority, in company with a number of males of *A. lucens,* were taken in the Forêt de Chaïba at 2000 ft. elevation, flying near the ground about a *Genista* that was not in bloom. Of *Xylocopa cyanescens,* Brullé, I took but one, whereas *X. violacea* was fairly common, frequenting Asphodel among other flowers; a solitary *Nomada agrestis,* Fabr., turned up. Other bees met with were: *Ceratina cucurbitina,* Rossi, one; *Chalicodoma sicula,* Rossi, one; *Chalicodoma* (?) *sp. nov.,* one; *Osmia kohlii,* one ♂, two ♀; *O.* (?) *notata,* Fabr.; *Anthidium siculum,* three; *Eucera trivittata,* one; *Eucera* sp., three; *E. numida,* Lepel., a ♂; *Podalirius pilipes,* seven at flowers of *Vinca* sp., also a variety of the male flying along the road in the Forest; *P. dissimilis,* Friese, one at flowers of *Jasminum fruticans; P. nigrocincta,* Lepel., ♀ var.; *P. dispar,* four specimens, one of them, ♂, at flowers of the Boraginaceous plant *Solenanthus lanatus,* D.C.; *Bombus terrestris,* two ☿ visiting flowers of *Solenanthus,* two ♂ at flowers of *Coronilla valentina,* Linn., in the fir-wood on a dull day when there was little moving; *Psithyrus vestalis,* Lepel., a ♂; *Apis mellifica*; also an unnamed bee which had five pollinia, probably of the Orchid *Ophrys lutea,* Cav., on its head.

Flies are far more delicate in structure than Bees and Wasps, so that they are more difficult to preserve, moreover, they are far less well known, so that it is hard to get them named. Hence the following list does not include all the species that I brought home. The genus *Bombylius* is certainly represented by more individuals in Algeria than in England; of *B. medius,* Linn., I took three males and two females; I also took another species to which Mr. Verrall could not assign a name. Of the familiar *Empis tessellata,* Fabr., I brought home two, and a like number of another *Empis* not yet named; there are a male and a female of *Lucilia* sp.; a female of *Pollenia rudis,* Fabr.; a specimen of *Oligodranes* (?) *fumipennis,* Loew; also two of *Usia* (?) *atrata,* Meig.

Hammam R'ihra yielded but a solitary Dragon-fly—*Orthetrum chrysostigma,* Burm.; and only three kinds of Grasshoppers—*Thalpomena algeriana, Acridium aegyptiacum,* and *Epacromia strepens,* of which last I got three specimens.

My Bugs included a *Centrocarenus* (*Centrocoris*) *variegatus,* Kolen.; *Camptopus lateralis,* Germ.; *Carpocoris purpureopennis,* De Geer, a fetid insect of which I took three, one of them on Asphodel; and several larvae of a Lygaeid, (?) *Apterola pedestris,* Stål, a gregarious creature, a hundred or so being found under one stone.

My named Beetles comprised *Copris hispanus,* of which one of each sex came to light; *Scarabaeus cicatricosus,* Lucas, found on the

road; *Rhizotrogus*, two of a species not in the National Collection; *Tropinota hirtella*, abundant on Asphodel and other flowers; *Dasytes cyaneus*, Oliv., abundant on the flowers of *Centaurea pullata*, Linn., and on the yellow flowers of a Hawkweed-like Composite; *Drypta dentata*, Rossi, one under a stone; *Pachychila impressifrons*, several under stones; *P. kunzii*, Sol., one under a stone on the top of Samsam; *Agapanthia asphodeli*, Latr., a small Longicorn which bears a strong cryptic resemblance to the unopened buds of the flower from which it takes its name; it was not uncommon but was difficult to see, for not only were its general shape and colour like the buds, but its antennae closely resembled the narrow bracts of the inflorescence; *Cantharis viridissimus*, Lucas, three on the yellow flowers of the somewhat mustard-like Crucifer, *Hirschfeldia geniculata*, Batt.; *Epilachna* sp., not in the British Museum, two; *Apion* sp., one.

At Hammam R'ihra I was greatly struck by the strangely close superficial resemblance between the perianth of *Aristolochia longa*, Linn., and the spathe of the Aroid, *Arisarum vulgare*, Targ.-Toz., a resemblance which I cannot attempt to explain as other than purely accidental.

Attracted by the glowing accounts of the flowers of the lower plains we went by rail on March 27th to AFFREVILLE, but the results were disappointing alike as regards flora and fauna. At Bou Medfa station I took a new Bee, *Melecta luctuosa*, Scop., a female. At Lavaranche the widely-distributed Pyrale, *Scopula ferrugalis* turned up, and Miss Donald found an immature Mantid, *Empusa fasciata*, Brullé, on a Palmetto (*Chamaerops humilis*, Linn.). At Affreville station I got the Grasshopper *Acrotylus insubricus*, Scop., and a single example of *Synchloë daplidice*. At Affreville itself the now familiar *Euchloë belledice* and *E. belia* were met with, as well as *Chrysophanus phlaeas*. The only other captures were the Aculeates *Podalirius dispar*, a male, and *Dielis ciliata*, together with the Bug *Camptopus lateralis*.

CHIFFA GORGE, BLIDAH, *circa* 1200 ft.

April 1st, 1905.

A visit to the celebrated GORGE was successful in so far as we got an excellent view of the Apes at quite close quarters. The only Butterflies that I actually captured were a male of *Ganoris napi*, the only one seen, and two males and one female of *Thestor ballus*. My note-book, however, tells me that in addition I saw *Ganoris brassicae*,

Gonepteryx cleopatra, Euchloë belemia, Pyrameis cardui, Pararge meone, and *Coenonympha pamphilus*, as well as *Macroglossa stellatarum*, a very common Moth in Algeria.

The two Cetoniids, *Tropinota hirtella* and *Oxythyrea stictica*, were obtained on flowers. The common *Polistes gallicus, Apis mellifica, Xylocopa violacea, Dielis ciliata* and *Andrena flavipes*, were accompanied by the less common *Eucera numida*, a female, *E. longicornis*, Scop. (a British species), a male, and *Podalirius atro-albus*, Lepel. Of *Acridium aegyptiacum*, I took a pair; the female had but one hind-leg when caught.

On March 31st I saw in a public garden at Blidah two specimens of *Grapta* sp., but had no net with me; on the following afternoon, at about the same hour, I went again in search of them, but it was cloudy and they were not to be found. It is interesting that Mr. H. J. Elwes, F.R.S., commenting upon Mr. E. G. B. Meade-Waldo's statement that he had seen *Grapta C-album*, Linn., high upon Tizi Gourzá in Morocco, stated, "I am not aware that this has been taken in North Africa before." [1]

Mustapha.

April 1st—3rd.

A number of moths came to the hotel lights:—*Cucullia chamomillae*, one; *Agrotis puta*, seven; *Cirphis albipuncta*, three; *Hadena oleracea*, Linn., one; *Xylophasia solieri*, Boisd., one; *Chloridea (Heliothis) peltigera*, Schiff., one; *Eupithecia centaureata*, Fabr., one; and the pretty little *Phtheochroa rugosana*, Hübn., one.

Guyotville.

April 3rd.

My visit earlier in the year had impressed me so favourably that I decided to spend my last day in Algeria on the dunes. Naturally on my second visit insect life was more obvious and more varied, and it seems probable that even later in the season still better results would be obtained. The wild area is, however, not what it once was, having been greatly reduced by cultivation, and at the time of my visit the process of "improvement" was still in full swing.

The Butterflies were somewhat disappointing. A big *Papilio podalirius* failed to produce the thrill of excitement that it once did

[1] *Trans. Ent. Soc., Lond.*, 1905, p. 373.

There were two or three of a *Gonepteryx*, also a *Ganoris* of sorts, as well as three or four each of *Euchloë belemia*, and *E. belia*; I also saw several *Pararge meone*, a lot of *Pyrameis cardui*, two *Chrysophanus phlaeas*, as well as a Blue that evaded capture.

Neither were Beetles very numerous or striking. A few *Pimelia subquadrata*, Sol., crawled upon the sand, and one *P. platynota*, Fairm., was found on the road. In the flowers of Marigold (*Calendula monardi*, Bois. Reut.), *Acmoeodera discoidea*, Fabr., was common enough. Two species of *Erodius* might be seen running on the sand, a solitary specimen of *E. vitrei*, Sol., and half a dozen of a species allied to *E. carinatus*, Sol., which does not appear to be represented at South Kensington; this remark applies also to an *Onitis* caught flying along the road. The abundant *Tropinota hirtella* was there of course.

The Grasshopper, *Acrotylus insubricus*, was the sole member of its order taken. Two Coreid bugs, *Verlusia sulcicornis*, Fabr., were the only Hemiptera. Of Flies I brought home *Sarcophaga* sp.; *Anthrax* sp.; *Bombylius* sp.; a large red *Myopa*; *Bibio* (?) *hortulanus* Linn.; *Usia aenea*, Latr., three; and *Rhyncomyia petalus*, Wlk., three.

The commonest Aculeate was certainly *Dielis collaris*, Fabr., of which I brought away seventeen; while of its congener, *E. ciliata*, I took three only; but by far the most striking of the group was *Scolia bidens*, Linn. It was the first time that I had seen this fearsome insect alive, and I spent much time in securing seven males and three females, all taken close to high-water mark at Mignonette (*Reseda propinqua*, R.Br.). Its exo-skeleton has notable pin-resisting power. Of the common Wasp, *Polistes gallicus*, I took five; of *Colletes acutus*, one; of *Prosopis fertoni*, Vach., five; and of a variety of *Sphecodes fuscipennis*, Germ., one. Of other Bees I took a female *Halictus* that is probably *malachurus*; a female of *Dioxys tincta*, Jur; a male *Nomada agrestis*; nine *Osmia ferruginea*, Latr.; three *O. rufigastra*, Lepel.; three *O. spinolae*, Lepel.; two *Anthidium siculum*; three *Podalirius atro-albus*; seven of the Mason-bee, *Chalicodoma sicula*. Of *Eucera algira*, I took but one female, but of another *Eucera* (*Macrocera*) which Mr. Ed. Saunders thought might be a new species, I was fortunate enough to get three specimens. The Ant, *Myrmecocystus viaticus*, brought up the rear.

Altogether it was a delightful day, the blue Mediterranean and the golden sands making a picture that lingers in the memory.

CHAPTER V

SOUTH AFRICA, 1905 [1]

CAPE TOWN, lat. 34° S. Sea-level.

August 8th, 1905.

SURELY no one who was on deck when the "Kildonan Castle" anchored in Table Bay will forget the impressive scene. Behind the town-lights which gleamed along the front the grand mass of Table Mountain, clear cut against a streak of dawn, lay under the Southern Cross and Magellanic Clouds: in the opposite quarter Jupiter and Venus shone brilliant beyond our experience, the latter reflected in the sea, while Orion standing on his head demonstrated that we were indeed in a Southern land. These astronomical facts had a bearing on our entomological operations, since we had to grow accustomed to the fact that the most promising hunting grounds were slopes with a *north-east* aspect.

Faithful to our own science rather than to the Association of which we were members, Dr. Dixey and I had decided to go on to Durban by the same steamer, and put in as many days collecting as possible on the Natal Coast. This left but a day and a half at CAPE TOWN, in which to get a glimpse of its fauna and flora, and we were truly fortunate in that the Southern spring smiled upon us and provided, if indeed few insects, at any rate what Mr. Boswell would have termed "some fine prospects." The drive under the imposing line of crags termed the Twelve Apostles is very fine, as is the view from the highest point of the road towards the north-east. Spread out at one's feet between Table Mountain and Table Bay lies the city, while in the far distance a range of mountains, at this season capped with snow, completes the picture.

[1] This chapter originally appeared in the *Transactions of the Entomological Society of London* for September, 1907, p. 309, as a joint paper by Dr. F. A. Dixey, F.R.S., and myself, entitled: "Entomological Observations and Captures during the Visit of the British Association to South Africa in 1905." My companion is not responsible for any points in which this account may differ from the original.

We were aware of the poverty in Rhopalocera of the Cape Peninsula, and Mr. L. Péringuey, the obliging director of the South African Museum, impressed the fact upon our minds, yet we were hardly prepared to find butterflies so scarce as in fact we did.

The best scheme seemed to be to drive to Camps Bay, stopping on the way to collect on the slopes of the Lion's Head, above Sea Point. While waiting for the carriage we took in the garden of the Mount Nelson Hotel, on Narcissus flowers, a few Honey-bees, *Apis mellifica*, of the somewhat brighter race *adansoni*, Latr., that is prevalent throughout South Africa, and with them their familiar mimic *Eristalis tenax*. An *Empis* was also common in the garden.

The country had all the appearance of early spring, and it was evident enough that we were much too early for good sport. Below the Lion's Head, by a little stream perhaps 200 ft. above sea-level, we took two specimens of the brownish Lycaenid *Cacyreus palemon*, Cram., quite unlike any Blue that either of us had previously seen alive; these and a Skipper that eluded capture at Camps Bay were the only butterflies we saw that day.

Turning over stones proved disappointing; besides sundry Scorpions and Myriapods the chief tenants were Ants, a larger yellowish species, *Camponotus maculatus*, Fabr., and a smaller black species, *Acantholepis capensis*, Mayr. With the ants were a few Beetles, such as two specimens of *Formicomus coeruleus*, Thunb.; an Anthiid, *Microlestia tabida*, Fabr.; another beetle not yet determined, and two larvae of a *Lampyris*.

Along with the beetles were sundry Cockroaches, creatures we were afterwards to find numerous; among them were two *Pseudoderopeltis juncea*, Sauss., and immature examples of possibly the same species.[1]

The best harbour for insects appeared to be a species of *Solanum*, a medium-sized, prickly shrub bearing numerous seed capsules. On this plant the red Lady-bird *Chilomenes lunata*, Fabr., was abundant, and a black species, *Chilocorus* sp., unrepresented in the National Collection, was fairly common. Several other Lady-bird-like beetles, as yet undetermined, were found on the same plant, as well as one specimen of *Epilachna hirta*, Thunb. (the sole phytophagous genus in a family otherwise carnivorous). On the leaves were also two examples of the tiny *Abacetus minutus*, Dej.

A dark-green, scarlet-striped Bug, *Lygaeus festivus*, Thunb., accompanied the Lady-birds, while immature specimens of the same

[1] Mr. Shelford says that it is not possible to determine with certainty the species, or in some cases even the genus, of immature cockroaches

were common inside the seed-vessels together with numbers of a fetid brown bug not yet named, and what we took to be beetle larvae. A third bug, of a pale scarlet colour when alive, frequented the same *Solanum*.

The few flowers that were out yielded nothing but a Honey-bee and an *Empis*.

At Clifton, Camps Bay, on the undercliff above the dazzling white beach, upon the flowers of a shrubby *Senecio*-like Composite, we took the small green Longicorn, *Promeces linearis*, Linn., the small bronzy Bee, *Halictus jucundus*, Smith, ♀, and *Apis mellifica*, two ☿.

A small Carabid, *Platynus rufipes*, Dej., found under a stone, completed our small bag. As we often experienced afterwards, the South-east Trade brought up clouds and gave us a dull afternoon, so that collecting was practically over at an early hour.

On a shrub in the Botanical Gardens, at about 4 feet above the ground I found a green Chamaeleon (*C. pumilus.*, Daudin) concerning which I shall have more to say later.

Port Elizabeth, Algoa Bay, Cape Colony, lat. 34° S. Sea-level.

August 11th.

The steamer did not give us a very long time at this place. After an early breakfast we took the train to Zwaartkops, some seven miles to the northward.

The coast here is flat and fringed with sandhills; by the railway the country is sandy and heathy; on the south side of the river its delta forms a level plain perhaps a mile wide between the sandhills and the railway, this is diversified by brackish swamps and intersected by streams. On the drier portions of this saline plain Termitaria are numerous, from 1 foot to 2½ feet high, and 2 to 3 feet across; on the surface they are smooth and hard as if "rendered" with cement, many-chambered within. One long ridge of sand was covered with thorny shrubs. The most conspicuous plant was a tall *Aloë* (?) *arborescens*, (?) *ferox*,[1] 6 or 8 feet high in full flower, but there were also at least two species of *Cotyledon* (*Echeveria*), and several species of *Mesembryanthemum*, one with large pink flowers, another with still larger yellow flowers, a third salmon-coloured, and a fourth shrubby, with small pink flowers. In such a locality

[1] The true Aloe, of the Nat. Ord. *Liliaceae*: the plant most commonly so named is the *Agave*, an American genus of the Nat. Ord. *Amaryllideae*.

it seemed quite natural to put up a couple of Hares. Low growing *Euphorbias* were many and varied, one appeared to be absolutely stemless, the involucres springing directly from the ground. There was also an ivy-leaved *Pelargonium*.

A fresh easterly breeze swept over the open ground and added to the difficulty of catching butterflies. The males of *Synchloë hellica*, Linn., were common, flying fast, and rarely settling; four specimens were secured. Of *Leuceronia buquetii*, Boisd., at least three were seen, two were secured, both males, but a third managed to get out of the net; they flew strongly. The proboscis of this butterfly when fresh is of a bright green colour like its eyes. *Colias electra*, Linn., was more restrained in its movements, and two males were taken. Of *Pinacopteryx charina*, Boisd., several were seen, also two or three individuals of an orange-tipped *Teracolus* (probably *omphale*, Godart), but it eluded all our efforts to effect its capture.[1]

On the lee side of bushes which afforded a slight shelter, the Lycaenid, *Leptomyrina lara*, Linn., was common, taking short flights and settling on the ground or on low plants. Nearer the sea on a sunny bank under the lee of the sandhills, the very beautiful and singular Lycaenid *Phasis thysbe*, Linn. (*osbecki*, Auriv.), was not uncommon, though apparently very local; it has a quick skipping flight and time allowed the capture of but two males and a female. In the same locality a pretty little rose-coloured Geometer, *Sterrha plectaria*, Guen., was fairly common, but unfortunately only two specimens were brought away. On the open plain the familiar and cosmopolitan *Nomophila noctuella* was often disturbed and two were taken, as well as a specimen of the scarcely less widely distributed *Scopula ferrugalis*, Hübn.

A piece of rough heathy ground near the railway station yielded two Satyrids, *Pseudonympha sabacus*, Trim., and others were seen near the same spot; the genus is characteristic of South Africa. Close by a small Blue, *Zizera lysimon*, Hübn., was netted, as well as a fine variety of *Sterrha sacraria*, Linn.

Under some planks lying on the sand of the river bank we found among smaller Bugs, our first specimens of *Physorhynchus crux*, Thunb. This large Reduviid, whose wings are so closely appressed to the abdomen that we for some time took it to be apterous, is very conspicuous when alive, the pale testaceous thorax and margins of the abdomen showing up the black cross upon its back, but the pale portions soon darken and the insect is dingy in the cabinet. The same planks afforded cover to a Slow-worm. This was a pale

[1] Dr. Dixey's ecstatic cry, "*Teracolus!*" still seems to ring in my ears.

yellowish fawn-colour above, with eight brown lines along the back; beneath it was white with a pink tinge of blood showing through its anterior half, giving it a very worm-like appearance. Under chloroform the animal was extremely violent and was some time in dying.

Turning over stones produced a few Beetles: single examples of *Lycanthropa synoecoides*, Ques., *Harpalus exiguus*, Dej., and *Blenosia* (*Blacodes*) sp., as well as two *Trigonopus* sp., the last two both represented at South Kensington, but unnamed. With the beetles were several Blattidae, to wit *Deropeltis erythrocephala*, Fabr., ♀, an immature *Pseudoderopeltis* sp., and three specimens of another Cockroach which stands unnamed in the National Collection.

An old Termitarium, long abandoned by its builders, afforded asylum to a number of insects, among which the most numerous and most conspicuous was the large Carabid *Microlestia rugosopunctata*, Thunb.; there was also a solitary Weevil, *Hipporrhinus appendiculatus*, Gyll.

The great spikes of Aloe proved attractive to Flies and a Bee, *Prosopis sandaracata*, Bingh. At the same flowers a Bird with a long thin tail was very busy, but whether catching bees or eating honey could not be determined.

The Hopliine beetle *Gymnoloma atomaria*, Fabr., was taken on a flower. Among Flies the cosmopolitan genus *Sarcophaga* was represented, and an Asilid, apparently a *Dysmachus*, was noticed to settle on the ground

While searching for beetles it was impossible to overlook the numerous empty spires of the large and handsome Snail, *Achatina zebra*, Chem. (*fulgurata*, Pfr.); one of them was tenanted by a stump-tailed Lizard which was purplish-grey spotted with olive-brown. A couple of Tortoises added to the picture, the carapace of one was about 5 inches, of the other nearly a foot long.

Among the Bees that we brought home was a little one (unfortunately not labelled) that was in all probability taken at Zwaartkops, though possibly at Cape Town, which turns out to be a novelty; the late Col. Bingham described it as *Halictus inornatus*, *sp. nov.*[1]

[1] Its description, with those of other Aculeata taken by us in South Africa, will be published in the *Trans. Ent. Soc. Lond.*, at about the same time as this volume. The paper was read May 3, 1911. See below, pp. 196, 207, 212, 236, 245.

EAST LONDON, CAPE COLONY, lat. 33° S. Sea-level.

August 12th.

An eager reconnaissance from the deck before breakfast revealed a tempting spot a mile or two to the north-east of the town where hills of blown sand capped by scrub suggested many possibilities. Accordingly we landed at the earliest opportunity and took a carriage. The road from the quay alongside the inner harbour brought us in a very few minutes into the QUEEN'S PARK, through which we were to drive. Our attention was at first caught by the weird forms of gigantic tree-Euphorbias,—strangely contrasting with the stemless form seen at Port Elizabeth—but these were soon forgotten, for as we passed the park gates we seemed to enter a very preserve of Butterflies. To one of us the sight was new as it was beautiful, to the other it brought back vivid recollections of India and Ceylon; both agreed to dismiss forthwitb the Kaffir driver, who, while he pocketed his easily-earned fare, doubtless pondered on the strange developments of European civilization and the increase of lunacy consequent thereon.

The park is formed out of a piece of the primaeval scrub of varied growth, filling a horseshoe-shaped hollow between the town and a tributary of the Buffalo. It is intersected with roads, footpaths, and streams; in parts are artificial shrubberies and flower-beds, which are gradually ousting the natural scrub. In the varied scene of insect life the most obvious characters were clouds of *Mylothris agathina*, Cram., of both sexes, their brilliant white and orange colouring showing clearly as they fluttered slowly and fearlessly over the large bushes of Poinsettia, *Euphorbia pulcherrima*, glowing with their scarlet bracts. The males give out quite a strong scent very closely resembling that of sweet-briar. Amongst the *agathina* we took three specimens of the nearly allied *rüppellii*, Koch, of both sexes, and in another part of the park a single male of the delicate *trimenia*, Butl., with its pale yellow hind-wings.

Less showy, but almost equally common, was *Belenois severina*, Cram., the Common White of this part of the world. Both sexes were well represented, the male having a distinct scent. All were of the dry-season form; some were very small. Of *B. gidica*, Godart, a single male was taken, also strongly scented. Of the more gaudily coloured *B. zochalia*, Boisd., two males and a female turned up.

Terias was represented by a single *brigitta*, Cram., a male; *Colias* by two *electra*, also males; and *Teracolus* by two *omphale*, one of

each sex. Last, but not least beautiful of the Pierines was *Eronia cleodora*,[1] Hübn., of which five specimens were taken, while a male *E. leda*, Doubl., was netted, but managed to get away.

The widely-ranging *Danaida chrysippus*, of the typical African colouring, which, as is well known, is darker than in the Indian form, was flying slowly about in some numbers; two females that were taken yielded the musk-rat odour.

Another butterfly that was very common was the Nymphaline, *Eurytela hiarbas*, Drury. It has a curious slow flight, gliding backwards and forwards about bushes, for flowers seem to have no attraction for it; but if the flight of this butterfly, and its coloration, brown with a transverse white band, remind one of the *Neptis* group, its general appearance and shade-loving habits suggest a Satyrine. *E. hiarbas* usually settled on the ground with wings more or less expanded and from time to time slowly closed and opened them again; it oriented itself with tail to the sun, but not very accurately. Conspicuous amongst the Nymphalines was our old friend *Pyrameis cardui*, mostly in poor condition, but one was very fine. The large genus *Precis* was represented by three species, *sesamus*, Trim., *archesia*, Cram., and *cebrene*, Trim., the latter not uncommon. One specimen of each was secured, but we had our first lesson in the elementary fact that to see a *Precis* is not always the same thing as to catch it.

A sunny bank cleared of scrub was grown over with a *Senecio* not unlike the Oxford *squalidus*, Linn. Amongst these flowers *Byblia goetzius*, Herbst, was rather common, often settling on the ground; they were all females, one of intermediate character, the rest "dry." A single *B. ilithyia*, Drury, was "very dry." This and a specimen taken at Ladysmith were all of this species that we saw in South Africa.

One of the spots in the park where butterflies were especially numerous was a sunny bank close to an open drain whose black stream evolved so much sulphuretted hydrogen as to suggest pollution by a laundry. Some Poinsettia bushes (including one with the bracts pale yellowish instead of the more usual scarlet), growing where the smell was most sickening, proved quite as attractive to butterflies as others in sweeter situations.[2]

A few fine blue and black Papilios dashed about to tantalize us (they were almost certainly *P. nireus*, Cram., f. *lyaeus*, Doubl.), but

[1] *It is well known that the local races of E. cleodora show great differences in* the amount of black bordering to the wings. This in the East London specimens is reduced to a minimum. See Dixey, *Proc. Ent. Soc. Lond.*, 1905, p. lxvi.

[2] Compare my experience near Darjiling (p. 89), and at Hongkong (pp. 127, 128).

the common South African *P. demodocus*, Esp., proved much easier to capture, and between the park and the town two specimens fell victims to our nets; one of them seemed to have been injured by a bird.

Satyrines were conspicuous by their absence. A single female specimen of the common, dingy, South African Skipper, *Gegenes letterstedti*, Wallgr. (*hottentota*, Latr.) was the sole Hesperid seen, but the Lycaenids were better represented by a solitary male of the far-ranging *Tarucus telicanus*, Lang, and several specimens of the "amphisbaenoid"[1] tailed and lobed Blue, *Argiolaus silas*, Westw. This has a rapid and jerky flight and is fond of settling high up, so that the observation of its false head and its attitude at rest was attended with difficulty, but a male and four females were easily taken off the red blossoms of a tall shrub.

The only Moth captured was a male Lymantriid, *Euproctis mesozona*, Hmpsn., which flew fast in full sunshine; this is a species represented in the National Collection solely by the type.

Among other orders the Diptera were represented by an *Idia* and another fly; we did not take a single beetle, being indeed too busy with the butterflies. There were many small Grasshoppers in the coarse grass by the foul stream, the most striking being the common South African *Catantops melanostictus*, Schaum, whose red tibiae and striped femora render it conspicuous. The only Aculeate taken was a worker *Belonogaster praunsi*, Kohl, one of two seen on the same plant. This genus, very characteristic of the country, has an extremely long peduncle to the abdomen. We took a specimen of the Sawfly *Athalia himantopus*, Klug, a species that Colonel Bingham said was widely spread over the African continent. The Bug *Atelocera stictita*, Westw., was caught flying: during life its underside is covered with a white waxy substance.

Among the things that we saw that morning, but did not catch, were a *Charaxes*, an *Amauris* (probably) and *Atella phalantha*, Drury.

DURBAN, NATAL, lat. 22° 50′ S. Sea-level.

August 13th—21st.

At DURBAN we had the great advantage of an introduction to Mr. A. D. Millar. This gentleman and the members of his family are enthusiastic entomologists. It had been our intention to go northwards and explore the country about the mouth of the Tugela, but, acting on Mr. Millar's advice, we decided to stay in Durban and

[1] The *Amphisbaena* is a legless Lizard which, it has been alleged, can move either backwards or forwards.

so make the best use of our time, which was here, as elsewhere, all too short.

The Ocean View Hotel in the residential suburb called THE BEREA is perhaps 200 ft. above the sea; its garden yielded a few of the commoner butterflies—*Papilio dardanus*, Brown, f. *cenea*, Stoll, a male, *Precis clelia*, Cram., *Mycalesis safitza*, Hew., both sexes, and *Zizera lucida*, Trim., a male.

Lanes and bits of open ground near the hotel, still retaining much of the character of the primaeval scrub, afforded fair collecting. It was in such a place that we were much excited at beating out our first *Salamis anacardii*, Linn., a large greenish Nymphaline very leaf-like on the underside and with a peculiar satiny sheen that gives it a very tropical aspect. There we found late in the afternoon both sexes of *Danaida chrysippus*, with them were less familiar butterflies, *Acraea terpsichore*, Linn. (*buxtoni*, Butl.), several feigning death in the net; *A. cabira*, Hopff., one; a pair of *Precis sesamus*; an example of *Eurytela hiarbas*, also several specimens of *Byblia goetzius*, of both sexes, all more or less "dry" in character; this butterfly flies low down rather quickly, settling usually on the ground under a bush, but is easily disturbed. We also took at the Berea two males of *Belenois severina*, two males and a female of *Mylothris agathina*, and one of each sex of *Terias regularis*, Butl. Of smaller things we took one each of *Zizera lysimon*, and *Gegenes letterstedti*, while beating produced a Geometer, not yet identified.

The glow-lights of the hotel only yielded the Boarmiid *Tephrina arenosa*, Butl., and two Noctuae:—*Ophiusa mejanesi* Guen. (a moth that occurs in India, coming very near to Walker's type of *expedita*, a species sunk by Sir George Hampson), and *Ethiopica* (*Caradrina*) *micra*, Hmpsn. A humble Fly, *Homalomyia canicularis*, Linn., was an inmate of the hotel.

Sandy banks by the roadside were haunted by various Fossors, two of which, *Liris haemorrhoidalis*, Fabr., a male, and *Pompilus diversus*, Smith, a female, exhibit Lycoid coloration, the last-named more especially, with its yellow-brown wings tipped with black. It may be explained that it is well known that in Africa a great many insects of various orders are coloured like the distasteful Malacodermatous beetles of the family *Lycidae*, orange-brown tipped with black posteriorly.[1] With these were two of the slender yellow and black *Dielis fasciatella*, Hübn., both males. The Syrphid fly, *Eristalis taeniops*, Wied., was too handsome to be passed by.

[1] See G. A. K. Marshall, *Trans. Ent. Soc., Lond.*, 1902, pp. 340, 344, 380, 515–518, and Plate XVII.

The first of his favourite localities to which Mr. Millar directed us was the Old Cemetery at SYDENHAM. About three miles to the north of Durban, it lies on the north (sunny) side of a hill sloping very gradually towards the Umgeni River, and may be some 400 ft. above sea-level. The Cemetery itself is small, neglected and overgrown with coarse grass and herbage, which doubtless nourishes many larvae, while there are enough flowers to attract butterflies. The grassy lanes on either side afford excellent collecting ground, and, although most of the land around is cultivated, there is some scrub to the south.

Here we found, beside our familiar friend *Danaida chrysippus*, our first specimens of *Amauris albimaculata*,[1] Butl., both males. Single specimens of the beautiful dark red *Acraea petraea*, Boisd., and of *A. natalica*, Boisd., a male, were taken. The fore-wings of the last-named are, when the insect is fresh, of a fine rose-crimson, the hind part of the abdomen (in the male) being banded above with pale rose-pink and white, but white beneath. Males of *A. terpsichore* were fairly common, especially among dead grass. *A. encedon*, Linn., of which two examples were taken, was so successful in its mimicry of *D. chrysippus* as at first to make the writer believe it to be that species.

In the Cemetery a few males of *Hypolimnas misippus*, Linn., were sailing around, flying high and seldom flapping their wings, but no females were observed. In an open space within the enclosure, as well as in a cleared mealy-field adjoining, the "blue-eyed" *Precis clelia* was locally common, settling on the bare earth and on the grave-stones; with them were a couple of *P. cebrene*, but that species was commoner in the dry bed of a spruit half a mile to the north; some of the specimens were very small. Three examples of *P. natalica*, Feld., were taken; *P. sesamus* was not uncommon. Only two *Precis* (*Catacroptera*) *cloantha*, Cram., were seen, one of them in the dry spruit. *Eurytela hiarbas* was very common about hedgerows. Single specimens of *Pyrameis cardui* and *Salamis anacardii* turned up. Several male specimens of *Byblia goetzius* were taken, but it was hardly common. To effect the capture of *Charaxes varanes*, Cram., required considerable negotiations, as its flight is both high and strong, but it has a habit of settling at the end of a prominent twig, and is then fairly easily detected in spite of the resemblance of its under-surface to a leaf.

Of *Mycalesis safitza*, two females were taken, one near the

[1] For the specific distinctness of this form from *A. echeria*, Stoll, see Rothschild and Jordan, *Novit. Zool.*, x. 1903, p. 504.

Cemetery, the other in the village of Sydenham (a mile nearer Durban), they were flying in full sunshine in the early afternoon. Of *M. perspicua*, Trim., three males were taken among dry grass, etc., near the before-mentioned spruit; they were rather common there, but of restless habits, so that it was very difficult to see them settle. It was interesting to find that on separation of the wings and stroking the patch near the costa of the hind-wings they gave out a very strong scent quite distinct in character from that of *M. safitza*, which has one of the strongest scents known to me.

Of *Belenois severina*, a male was taken, but *B. gidica* appears to have been commoner, since three males and a female were brought home. Three *Pinacopteryx pigea*, Boisd., two males and a female (near Sydenham village), and one *P. charina*, were taken. We met with but one *Mylothris agathina*, a male, but *Eronia leda*, Doubl., was not uncommon, flying rapidly along a lane near the Cemetery, often in company with *Teracolus auxo*, Lucas; it was hard to catch, but three males and a female were secured. The genus *Teracolus* was more dominant at Sydenham than at any other locality which we visited, the most abundant species, especially in fields, was *T. auxo* (the dry-season form called by Wallengren *topha*); the males of this species appeared to outnumber the females by two to one. On one occasion a specimen of *auxo* and one of *Eronia leda*, both males, were in the net together, they were duly pinched, and as the net was lying open on the ground another *auxo* (sex not known) came and settled on it close to the dead butterflies. The next commonest species was *T. annae*, Wallgr. [dry-season phase = *wallengrenii*, Butl.], of which thirteen males and one female were taken. On the other hand, of *T. omphale* we took but three males and one female, and of *T. achine*, Cram., a like number, while of the lovely *T. phlegyas*, Butl. [according to Trimen = *ione*, Godart], we secured but a single male, of which it was noted that the purple tip was not apparent in flight. Butterflies of the genus *Terias* were in abundance locally, the specimens brought home proved to be *T. regularis*, four males (one of them intermediate in character, the rest "dry"), and *T. senegalensis*, Boisd., one male, "dry." The only other Pierine taken was *Colias electra*, on the road about a mile on the Durban side of the Cemetery; the species was not common.

One *Papilio dardanus* was taken at Sydenham, but *P. demodocus* was common; it flew fast but generally not very high, twice at least it was observed to flutter its wings when feeding, as its congener *P. demoleus*, Linn., had been observed to do in India. A specimen taken in Sydenham village was very small.

A considerable variety of Lycaenids was taken, though they cannot be said to have been abundant: *Virachola antalus*, Hopff., a male; *Hypolycaena philippus*, Fabr., a female; *Axiocerces harpax*, Fabr., a male settled on a rose-bush in the Cemetery; *Polyommatus baeticus*, one; *Zizera lucida*, two females; *Z. lysimon*, one on the way; *Lachnocnemenea bibulus*, Fabr., four, in the Cemetery. This species sits with the abdomen turned up at an angle of 45° (like *Euchloë*); I never saw this butterfly drinking, but it is fair to assume that the collector who sent the specimens to Fabricius reported its habits as he had observed them: its specific name would well describe many a Blue. In addition *Catochrysops malathana*, Boisd. (*asopus*, Hopff.) turned up; while on the slopes of the spruit before mentioned I met with a single example of *Alaena amazoula*, Boisd., a female, which was very cryptic among the grass where it was found. In general appearance this species so closely resembles a tiny *Acraea* that at first it was placed next to that genus.

The Skippers again were varied rather than numerous, single specimens being taken of each of the following:—*Sarangesa motozioides*, Holland, almost invisible as it sat on a rock in the spruit with its wings spread out flat; *Netrobalane canopus*, Trim., resting with expanded wings on the upper side of a *Solanum* leaf; *Parnara fatuellus*, Hopff.; *Gomalia albofasciata*, Moore; the large species *Rhopalocampta pisistratus*, Fabr., and *R. forestan*, Cram.; lastly *Caprona adelica*, Kirsch, a prettily marbled butterfly with a scaleless patch on the fore-wing, of which there are but two specimens in the British Museum.

The Syntomids *Pseudonaclia puella*, Boisd.; *Syntomis simplex*, Walk. (two), a metallic-blue thing easily caught; and *Euchromia formosa*, Guér., were taken flying, the latter near the spruit. A crippled specimen of the singular Geometer, *Caenina poecilaria*, H.-Schäff., was taken in the Cemetery, a better one missed in the spruit, both among long grass.

The following Hymenoptera were taken: *Xylocopa divisa*, Klug, a male; a grey Wasp, *Icaria cincta*, Lepel., ☿; the Ant *Camponotus maculatus*, eight specimens under a stone; and an undetermined Ichneumon-fly.

The great order Coleoptera was very poorly represented by two Lady-birds, *Ortalia* sp., beaten out of a Composite creeper (apparently a *Senecio*), the species is represented in the British Museum, but unnamed; three *Haplolycus*, apparently of two species (one possibly *congener*, Gerst.), were either beaten out of, or taken flying about the same creeper; *Acantholycus constrictus*, Fabr., was caught flying slowly;

two specimens of *Anomalipus porcatus*, Sol., were found under a stone; and four specimens of a Heteromeron, *Opatrum* sp., apparently in the National Collection, but unnamed, were also found under stones.

Stone-turning also yielded an extremely flat Slug; it was of a pale greenish-grey, obscurely reticulated with darker, whitish beneath —probably *Vaginula* sp.

The Bugs, at least as regards individuals, were somewhat more plentiful; beating the climbing Composites (one with yellow, another with lavender flowers) revealed a number of the fetid Pentatomid *Antestia variegata*, Thunb., black, with orange spots, and pale yellow markings, these were at first taken by both of us to be Lady-birds; two other fetid Pentatomids, *Holeostethus goniodes*, Dall., and *H. scapularis*, Thunb., were also taken.

There were two as yet undetermined Acridians among our captures as well as the common *Catantops melanostictus*. Also a Dragonfly, *Orthetrum fasciolatum*, Ramb.

The Botanical Garden lies on the slope of the hill between the Berea and the Racecourse, and comprises portions of the original scrub, so that it naturally harbours many butterflies. Amongst these was a small female of *Danaida chrysippus*, which was actually mistaken by the author for its mimic *Acraea encedon* (of which three specimens were captured), while *per contra* the *Acraea* was mistaken for the Danaine! A single specimen of *Planema esebria*, Hew., and two of *Acraea cabira* were netted; one of the latter settled on a leaf with wings closed was inconspicuous. Of *Amauris albimaculata*, a male and two females were taken.

Eurytela hiarbas was common in the wooded parts of the garden, where also three *Precis elgiva*, Hew., were secured, together with two *P. natalica*, of the dark, or intermediate form (one very tattered), sitting on leaves with wings fully spread. The same bit of surviving scrub yielded two of the Satyr-like *Crenis boisduvalii*, Wallgr., one of each sex. *Neptis agatha*, Cram., was not uncommon, but as the garden is a good deal exposed to the prevalent south-east wind many of the specimens were worn. *Salamis anacardii* was beaten out at 4.45 p.m.: it had a very slow flight. Of *Byblia goetzius* we took a male of the dry-season form. In a shady spot were two *Melanitis leda*, Cram., the only specimens that we met with in South Africa. *Mycalesis safitza*, with its *janira*-like flight, was not uncommon in the shade; the four specimens taken in the gardens were all females of the dry-season form (var. *evenus*, Hopff.).

Belenois severina was common; though the large majority were

"dry," amongst them was found a "semi-wet" male. It was noted of a pair *in cop.* that the male supported the female in flight. Only one *B. gidica,* a male of the dry-season form, was taken. But if not quite the commonest White of the gardens, certainly *Pinacopteryx pigea* was the most characteristic; a dozen specimens, both sexes about equally balanced, were secured, they were all of the "dry" form (*alba,* Trim.); it appeared to be an earlier riser than many butterflies. A pair were observed *in cop.,* the male supporting the female, and when settled enclosing the female between his wings. Of *P. charina,* two of each sex were taken, one of the females was less "dry" than the rest. *Mylothris agathina* was scarcely common, males prevailing. In the more open grassy parts a few *Teracoli* were to be got: of *T. speciosus,* Wallgr., we took two males; *T. omphale* was commoner, and we took five males and two females; of *T. achine,* one of each sex. Of *Eronia cleodora* we took but one; *Terias regularis* was common enough; six specimens taken proved to be all females, of the dry-season form. We did not meet with this species outside Natal.

Just outside the hedge of the Botanical Garden a fine *Papilio morania,* Ang., was taken flying low and settling on wayside plants, along with *Belenois severina*; others of the genus were *P. demodocus,* a male; *P. dardanus,* two males, a species that does not fly as fast as many of its congeners; *P. nireus,* f. *lyaeus,* a male and two females.

The *Lycaenidae* were conspicuous by their scarcity, only two being met with—*Hypolycaena philippus,* a male taken as late as 5 p.m., and *Zizera lysimon,* two, one of them beaten out but little earlier (together with two *P. pigea* and two *B. severina*).

But if Blues were scarce it was far otherwise with Skippers: of our old friend *Gegenes letterstedti,* seven were taken, five being males, two females; this sits in the familiar Skipper attitude, but the posterior third of the hind-wing is plaited; *Parnara fatuellus,* one; *Acleros mackenii,* Trim., seemed to be common but was hard to catch, a male only was netted; of *Pterygospidea flesus,* Fabr. (*ophion,* Drury), five specimens were secured; it has a rapid darting flight, dashing wildly up and down the glades like a flash of silver, and suddenly settling with wings widely spread like a *Boarmia,* usually (so far as our experience went) on the *upper* side of a leaf, though it was on at least one occasion seen to settle on the *under* side, which Mr. Trimen gives as its habit. The fine large Skipper *Rhopalocampta keithloa,* Wallgr., rests in a singular attitude, the wings are raised above the back but do not meet, since both primaries

and secondaries are curved outwards somewhat spirally, moreover the posterior half of the secondaries is curiously plaited over the abdomen; a specimen of *R. forestan* was beaten out as late as 4.45 p.m., darting away with a whirligig flight. On the other hand, it was noted that Skippers were very active one morning before 9 a.m.

FIG. 7.—*Rhopalocampta keithloa*. Position of wings in resting attitude, seen from behind.

The Lymantriid moths *Euproctis punctifera*, Walk., three males, and *E. stellata*, Dist., two males, were beaten out one afternoon, together with the Larentiid Geometer, *Epirrhoë subspissata*, Warr., and the Acidaliids, *Craspedia pulverosaria*, Walk., and *Idaea spoliata*, Walk., one of each; the Deltoid *Hypena thermesialis*, Walk. (*Ophiuche masurialis*, Guen.) three; the Pyrales *Bradina admixtalis*, Walk., one; *B. atopalis*, Walk., two; and some others not yet determined.

Only two Beetles were captured, one the Weevil *Strophosomus ancorifrons*; the other, *Cardiophorus* sp., was found under an old tarpaulin.

The sole Aculeate brought away was a beautiful light blue Bee, *Crocisa picta*, Smith, ☿, which with its rapid flight suggested a small dragon-fly.

Three species of Diptera were met with: *Eristalis taeniops*; *Syrphus aegyptius*, Wied.; and *Sarcophaga* sp.

A solitary Pentatomid bug, *Agonoscelis versicolor*, Fabr., was taken.

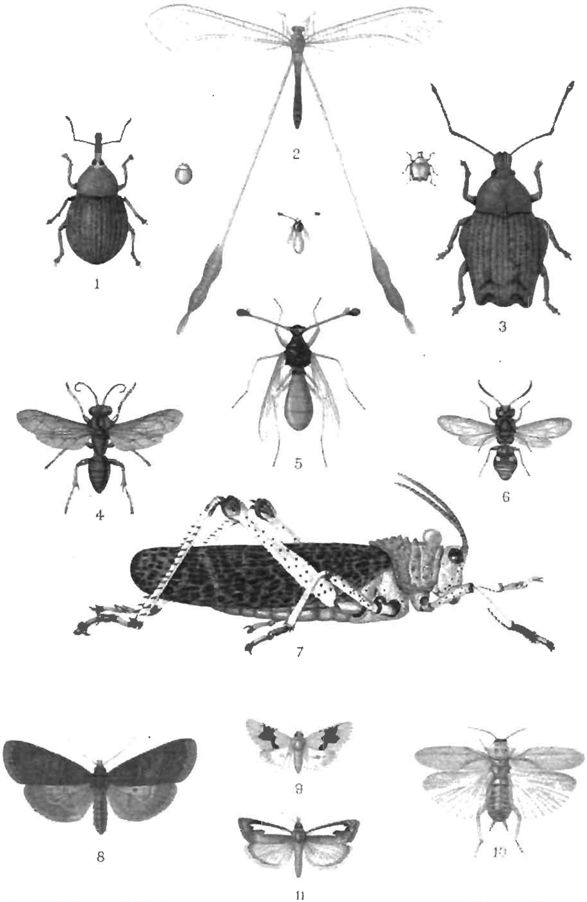
Of Dragon-flies we took one of a species not yet determined, and two that would appear to be *Orthetrum fasciolatum*.

From the gardener's point of view perhaps the most striking thing about the Botanical Gardens is the free use of the thorny *Euphorbia splendens* as an edging to beds; when we were there its brilliant red bracts were most effective. Those who have only seen small plants in the stove can form but little idea of its beauty.

In approaching Durban from the sea one first sights THE BLUFF, a ridge of high ground separating the harbour from the Indian Ocean. Access is obtained on the landward side by a steep path, which, protected from the sea winds and lying fully open to the sun, is the resort of many butterflies. At first it is hard to realize that south of the Equator hillsides with *northern* aspects are the entomologist's most likely hunting grounds. At the eastern extremity, near the lighthouse, the Bluff is more or less bare; but the path towards the west soon leads into the scrub, or natural forest, of mixed growth with a scarcely penetrable rank undergrowth of the coarse

Plate II.

SOUTH AFRICA.



H. and Edgar S. Knight del.

West, Newman Chromo.

1. MYORRHINUS LONGSTAFFI.
2. MEMOPISTHA LANCEARIA.
3. ELLIMENISTES CALLOSICOLLIS.
4. NOTOGONIA DIXEYI.
5. DIOPSIS AFFINIS.
6. ODYNERUS LONGSTAFFI.
7. PHYMATEUS LEPROSUS.
8. PARTHENODES SCOTALIS.
9. STEMMATOPHORA CHLORALIS.
10. ISCHNOPTERA LONGSTAFFI.
11. PLATYTES, sp. nov.

Acanthaceous plant called by the natives "u-Bomaan." Through the scrub there has been cut a very wide, grass-covered road, which keeping parallel to the coast, runs up hill and down dale for at least a couple of miles, how much further we had not time to investigate. This road with its occasional glimpses of the sea, perhaps 150 or 200 ft. below, afforded the most delightful collecting ground imaginable. One was constantly reminded of ridings through woods in Southern England, but rudely brought back to reality, once by catching the net in the well-concealed thorns of the familiar "fern-asparagus" (*Asparagus plumosus*) of our dinner-tables, another time by a glimpse of the dusky form of a cryptically-coloured Kaffir in the gloomy shadow of the forest. But everything has its drawbacks; that of the Bluff was climatic, for all too soon after midday, on both our visits, the south-east Trade-wind freshened and great clouds rolling up from the Indian Ocean sent all well-regulated butterflies to bed.

Danaida chrysippus was very common, especially towards the more civilized end of the road. *Planema esebria*, curiously enough the only species of the Acraeine group that we saw there, has a flight of moderate rapidity, but two were easily caught. Several *Atella phalantha* were seen and a few netted. *Precis* was represented by a single *clelia*.

Eurytela hiarbas was present but not common; of *Byblia goetzius*, two were taken, one of them less "dry" than usual. *Salamis anacardii*, with its slow flight, looked strangely smaller than it is; it soon settled on a leaf and appears to be a very sluggish insect. Two females of *Mycalesis safitza* are recorded from the Bluff.

By far the predominant butterfly was *Belenois severina*, which was very abundant; the males largely exceeded the females in numbers, but a good many of the latter were seen. Though the very large majority were of the dry-season type, intermediate examples were also present. They appeared to be markedly gregarious,[1] though this may have been due to the distribution of their favourite flowers. Two pairs were observed *in cop.*, the females, hanging down impassive, were carried by the males. Of *B. gidica*, which was far less common, we took two males and three females. Most of this species were seen near the bottom of the path leading from the harbour up to the lighthouse. Of *B. thysa*, Hopff., we took two males; when on the wing they closely resembled the male of *Mylothris agathina*, in

[1] Perhaps I apply the word "gregarious" to butterflies when "sociable" might be more correct. Certain it is that while many butterflies are solitary in their habits, others are found in companies.

flight and general aspect. Indeed, even as seen in the net the *Belenois* so closely mimics the *Mylothris* that though specially on the look-out I was deceived, and this even when the two insects were taken the same morning.

Pinacopteryx charina was decidedly common, but the sexes were very unequally distributed; we took seventeen males to two females. One male specimen had lost the anal angles of the hind-wings, probably from the bite of a lizard. Of *Glutophrissa saba*, Fabr., a male was taken. The beautiful *Eronia cleodora*, Hübn., was quite common; we took eighteen specimens which appear to be mostly males; it flies fast. The Plate forming the frontispiece of this volume gives a fair idea of the brilliance of the butterfly and the conspicuous arrangement of its strongly contrasted colours, but it shows even more satisfactorily its cryptic coloration when resting, as it was several times observed by us, upon or close by yellow, blotched and perforated leaves of the "u-Bomaan." This plant, now known as *Isoglossa woodii*, Clarke, belongs to the Natural Order *Acanthaceae*, and is *not* the food plant of the larva.[1] The underside of the hind-wing of the butterfly varies almost as much as the discoloured leaves, and the resemblance is general, that is to say, it is not a definite case of leaf-imitation. It should be noted that a coloured sketch of the leaves was made at the time, but in the absence of the butterfly, to avoid any tendency to exaggerate the resemblance. Mr. H. Knight's drawing is quite admirable.

Of *Teracolus achine* we took a male; of *T. omphale*, two of each sex; but we naturally paid more attention to the beautiful Purple-tip, *Teracolus speciosus*. This was not uncommon, and we secured six males and two females; during its flight, which is rapid, it looks like an ordinary White, the purple not showing on the wing. Butler named the "dry" form of this butterfly *jobina*, and considered the "wet" form to be the *ione* of Godart.

Of *Terias regularis* we took a male, and of *T. senegalensis* a female, both of the dry-season form.

We managed to get two specimens of *Papilio policenes*, Cram., but one of them was sadly battered; also one male of *P. dardanus*, f. *cenea*; a specimen of *P. nireus*, f. *lyaeus*, was easily secured flying low down when a cloud passed over the sun.

Curiously enough we took but a solitary Blue, *Virachola antalus*.

[1] It was a triumph of the Botanical Department at Cromwell Road to name this plant from three pressed leaves. It is figured in J. Medley Wood's "Natal Plants," vol. i., Plate XXII., under the name of *Ecteinanthus origanoides*, T. For further particulars, see Chapter X., § 14.

Single specimens of the Skippers, *Gegenes letterstedti*, a female; *Gomalia albofasciata* and *Parnara fatuellus* were taken, the last-named settled on a leaf in the sun, with the wings fully expanded; we also obtained two *Kedestes macoma*, Trim.

We kicked up from grass, etc., two specimens of the exceedingly variable Noctua *Ophiusa lienardi*, Boisd., one of them settled upon the ground; in like manner we turned np a battered example of the restless moth belonging to the same group, *Remigia repanda*, Fabr., and found another at rest upon a leaf in the full sun. Here also we took our first specimen of that beautiful Catocaline, the steel-blue and orange-yellow *Egybolia vaillantina*, Stoll, known to the Colonists as the Peach Moth, together with the Quadrifid Noctua *Rhanidophora cinctigutta*, Walk., pale fawn with large, neatly outlined, cream-coloured spots on the fore-wing; and the curious Geometer *Cartaletis libyssa*, Hopff., of which several were seen, but only one taken. This moth, orange, with a black white-spotted border to all the wings, looks like anything rather than the Boarmiid that it is. It flies rather high with feeble fluttering action, and when on the wing somewhat recalls *Danaida chrysippus*, or an *Acraea*; it also resembles *Acraea* by exuding a yellowish juice when pinched, but the juice in *Cartaletis* is odourless. These are three very striking and characteristic moths. Another Geometer, allied to our Magpie Moth, was *Zerenopsis geometrina*, Feld.

The Hyponomeutid, *Eretmocera scatospila*, Zell., and the familiar *Scopula ferrugalis*, complete the list of moths, so far as I have been able to assign them names.

The yellow and chocolate-coloured Lamellicorn *Macroma cognata*, Schönh., was very conspicuous on the wing; the Clavicorn *Episcaphula aulacochiloides*, Crotch, was taken under a log, associated with ants and fungi. *Asida bicostata*, Fåhr., and *Hister subsulcatus*, Mass., were also found under logs; a specimen was obtained of the phytophagous Lady-bird, *Epilachna infirma*, Muls. The Weevil *Sciobius pullus*, Sparm., a female, was beaten out of a Clematis-like creeper [? really a *Senecio*]. The Carabid *Arsinoë quadriguttata*, Casteln., was taken on low herbage.

Two Crickets were captured, also the Acridian *Monachidium viridipenne*, Burm., and others of the group still unnamed, including one which made a loud snapping noise in leaping, whereas the very spiny-legged *Acridium ruficorne*, Fabr., sat on a bush and made no attempt to escape. From under a log was unearthed an immature female Cockroach, which Mr. Shelford thinks may possibly be a new species.

A blue Wasp was taken, and several others seen; it turns out to be a new species and has been named by Colonel C. T. Bingham after the captor, *Notogonia dixeyi* [see Plate II., Fig. 4, also footnote, p. 182, *supra*]. Under a log were found numbers of the big-headed soldiers and thin workers of *Camponotus maculatus*.

The conspicuous Reduviid bug, *Physorrhynchus crux*, was common under logs of wood, corrugated iron, etc., near the lighthouse; it has a peculiar pungent odour.

The solitary Fly brought home was apparently the cosmopolitan *Sarcophaga carnaria*, Linn.

On the sandhills near the lighthouse were plenty of the widely distributed Snail, *Helix* (*Euparypha*) *pisana*, Müll., probably introduced.

Dr. Dixey found a horrible Worm in a surprising place, it was on a dry sandy path at about 3.30 p.m., on a dull afternoon. I call it horrible for it was nearly as thick as the finger and from 11 to 16 inches in length according as it was fully extended or otherwise. Its colour was of the olive-brown that one associates with seaweed, but it had a black ring, an inch wide, behind its head.

CONGELLA, some three miles to the west of Durban, is another very pleasant locality. The ground rises gradually from near the level of the harbour for perhaps a mile to the large banana plantations from 200 to 300 ft. above sea-level, the slopes being covered with wild scrub traversed by a woodland track, while through the lower portions are cut wide grass-covered roadways foreshadowing the development of an eligible building estate.

As usual, *Danaida chrysippus* was to be had; we took five males and a female. We took a female of *Amauris echeria*, and three females of *A. albimaculata*, the latter flew slowly and were easily caught. *Acraea* was well represented, the commonest species being the black, yellow-spotted *A. cabira*; one specimen of this was taken on *Lantana* flowers (for this Neotropical shrub has spread even to Natal), but as a rule it was seen flying about the tops of trees, in which situation it looked a much larger insect than it really is; thirteen specimens were taken, one of these which reached the hotel alive, having survived pinching as *Acraeae* so often do, proved very resistant to chloroform. *A. terpsichore* looks on the wing like a small British *Argynnis*; we took five. Of *A. petraea*, which when alive is very rosy, both above and below, we took two. Of *A. natalica*, we got one among grass; its hind-wings have a lovely rosy flush in life, indeed the beauty of many of these *Acraeae* cannot be appreciated from cabinet specimens; *A. encedon*, of which we took three, is a

feeble insect, with slow flight, and it again succeeded in passing itself off momentarily as *chrysippus*. The yellow juice expressed from *A. natalica* proved to be slightly acrid. A single male *Planema aganice*, Hew., completed the group.

Byblia goetzius flew over the grass like a "Pearl-bordered"; one settled on a red path, another on dead grass, both with wings erect, both inconspicuous; we took a male and four females, one of the latter was "quite dry." Two *Neptis agatha* were taken flying slowly. *Precis elgiva*, a retiring insect, was found in the track through the wood, of four specimens one was much battered; of *P. clelia* several were seen; of *P. natalica* two, of the dry-season form, one worn; of *P. sesamus* one settled closely appressed to the ground; also at the edge of the banana garden, on very red soil a *Precis* was seen three times quite clearly, but unfortunately missed; this was either *P. octavia*, Cram. (the wet-season form of *sesamus*), or something uncommonly like it; it nearly matched the red soil in colour, but was somewhat more orange in tint. Of *Salamis anacardii*, one of each sex was obtained; of *Atella phalantha*, a single example; of *Charaxes varanes*, usually a high flier, a female was luckily netted off a shrub. *Mycalesis safitza* was common; four males and nine females were taken.

No specimens of *Belenois severina* appear to have been brought back from Congella, but it was certainly common there; of *B. gidica* we took three of each sex, one had the hind-wings chipped symmetrically, apparently by a bird; of two specimens taken *in cop.* the male was "dry," the female "very dry." Of *B. thysa* we took six males, but we have no record of its model *Mylothris agathina* from that locality. Both these butterflies have strong scents, which are quite distinct. Of *Glutophrissa saba* and *Nychitona alcesta*, Cram., single examples were taken, the latter has a slow, flapping flight. Of *Eronia cleodora* we took two; of *E. leda* a single female; of *Pinacopteryx pigea* nine, four males and five females; of *P. charina* a solitary male. Congella is not the sort of locality that *Teracolus* especially delights in, and the genus was represented by but single male specimens of *T. achine* and *T. omphale*, and three males of *T. speciosus*. Of *Terias regularis* we took four males and two females.

Of *Papilio demodocus*, which frequents high and open ground, we took one in the cultivated region above the woods, but of *P. nireus*, f. *lyaeus*, we got four males by taking advantage of its habit of not infrequently flying low and even settling on the ground.

Of *Zizera lysimon* we took two; of *Tarucus telicanus* five, of which at least four were females, one with the fore-wings injured

apparently by a bird; of *Polyommatus baeticus* two; of *Castalius calice*, Hopff., one, a tattered specimen, and of *Virachola antalus* one female, boxed off a plant close to the ground; it was sitting head-downward, but the false head had been bitten off, so that it could not deceive again.[1]

Among the Skippers were the now familiar *Gegenes lettersledti*, two; *Parnara fatuellus*, one; *Sarangesa motozi*, Wallgr. (*pato*, Trim.), one; *Acleros mackenii*, one male and two females, this and other Skippers were more active on dull days than most butterflies; *Eretis djaelaelae*, Wallgr., one settled with wings outspread; and *Pterygospidea flesus*, seven. Of the last species several were seen to settle on the *upper* sides of leaves, with wings spread out like a Boarmiid.

The beautiful *Egybolia vaillantina* was rather common, it is a slow feeble flier, the wings flapping much, so it was easy to catch six specimens. The Lymantriid *Euproctis punctifera*, of which we took three males and a female, was very common, it is one of those insects which look on the wing far larger than they are, an appearance that may be due either to bright colour (in this case orange) or to the mode of flight. Of the small Syntomid *Pseudonaclia puella*, and the Chalcosiine *Anomoeotes levis*, Feld., we took two each, the latter looks surprisingly large on the wing.[2] Other moths taken were the Geometer *Gracillodes caffra*, Guen., one; the Pyrale *Antigastra morysalis*, Walk., one; the Hyponomeutid, *Eretmocera lunifera*, Zell., one, and several other unnamed Micros.

The Odonata were represented by two *Orthetrum fasciolatum*, ♂, and one *Brachybasis rhomboidalis*, Beauv.; the Orthoptera by a Cockroach found under a log, (?) *Deropeltis autraniana*, Sauss., immature; and an Acridian, *Tryxalis ståli*, Boliv., which was very hard to see, being shaped and coloured like a piece of dead grass or straw.

Near the reservoir, on a shrubby lavender-flowered Composite, were taken together the South African form of Honey-bee, *Apis adansoni*, and the Syrphid *Eristalis taeniops*, which was noticed to be a fairly close mimic of the bee, at all events when alive. Both insects are brighter than their British representatives.

The Beetles found at Congella were the Clavicorn *Megalodacne grandis*, Fabr., and the Heteromeron, *Anthracias taurus*, Fabr., both found under logs; also *Eudema nobilis*, Klug, and the very distinct Carabid, *Thyreopterus flavosignatus*, Dej., found under the bark of a dead stump among numerous ants.

[1] See p. 69, *supra*. Also Chapter X., § 10.

[2] Compare my observations on the Indian Chalcosiine, *Agalope hyalina*, Koll., near Simla, p. 44, *supra*.

FROM DURBAN TO JOHANNESBURG.

August 22nd, 1905.

The first point of the journey over the Highlands of Natal at which we had a few minutes' time to leave the luxurious carriages of the Government Railway was INCHANGA, 2470 ft. above sea-level. Here on some sandy ground near a stream bordered by rushes and coarse grass or on a bank with a few flowers (*Senecio* sp.) we took a dry-season specimen of the Satyrid *Pseudonympha cassius*, Godart; a Wasp prettily marked with rich brown, black and white, *Polistes fastidiosus*, Sauss., ☿; a handsome Braconid, *Iphiaulax whitei*, Cam.; and an apple-green Mantid larva; also by sweeping the *Senecio*, etc., two *Apis mellifica*, race *adansoni*, ☿; an Asilid (?) *Dysmachus* sp., and the Grasshopper *Catantops melanostictus*.

We spent the night at the Falls of the Umgeni, at HOWICK, lat. 29° 28′ S., 3400 ft. above sea-level, and before dark turned over a few basalt stones, taking a number of Ants, *Pheidolé irritans*, Smith; two *Blattae* with a very strong, sweet, really rather pleasant scent, suggesting pear-drops, or amyl acetate; they were immature and Mr. Shelford thinks they may possibly be a new species; a small Beetle, *Euleptus caffer*, Boh., and an Acridian, at present unnamed. It was cold at night here.

At ESTCOURT, lat. 29° 2′ S., alt. 3800 ft., on an open grassy place near the Station we were rather more successful. Two males of *Synchloë hellica* were secured; they were nôticed when at rest to withdraw the fore-wings completely between the hind-wings, and to raise the abdomen, just as *Euchloë* was observed to do in Algeria.[1] We also took a small Syntomid (as yet unnamed), a Lady-bird, *Epilachna similis*, Thunb.; two Ants, *Camponotus cosmicus*, Smith, and a Grasshopper, *Trilophidia* sp.; this last was originally discovered by Mr. G. A. K. Marshall, and declared by Señor Bolivar to be a new species, but it has not yet been named.

COLENSO, lat. 28° 46′ S., alt. 3200 ft. The late afternoon was spent on the low ground south of the Tugela, between the river where the Boers were so securely posted, and the spot where Colonel Long's guns were abandoned. The immense value of cover in modern war was made evident when one stood in the very shallow spruit which served for shelter to our men after the loss of the guns. The only butterflies seen were *Pyrameis cardui* and *Danaida chrysippus*. Several moths were kicked up, the Boarmiid Geometers *Osteodes*

[1] See p. 162, *supra*; also Plate V., Fig. 10.

turbulenta, Guen., two; *Zamarada pulverosa*, Warr., one; and *Nassunia petavia*, Stoll, a male; also two tiny Noctuae with yellow hind-wings, *Eublemma sperans*, Feld.; a Crambus and two Micros, none of them yet named. Two immature Acridians of the colour of dry grass were taken, also a Beetle, *Scaptobius natalensis*, Boh., one, and the Heteromeron *Opatrum* (?) *arenarium*, Fabr., six. Several specimens of the Ant *Pheidole irritans* were taken, also some Termites, two workers and two soldiers of the same community. The former when taken were carrying bits of grass and leaves; when brought back to the hotel they were dead and partly mutilated, apparently by the soldiers in the same pill-box. The soldiers, on the contrary, reached home alive and pugnacious, for they would grasp the point of the forceps and allow themselves to be lifted off the ground without letting go.

August 24, 1905.—The next forenoon we ascended Hlangwane, the hill commanding the whole position, which unfortunately Buller did *not* occupy on December 15th, 1899.

Some of the Boer trenches on the crest are so ingeniously constructed as to be invisible from the front, all excavated material being deposited to the rear on the reverse slope. But it must be remembered that these trenches were erected after our disastrous repulse, and that there was then no serious obstacle to an attack upon the Boer left and left-rear.

Again we saw no butterflies, and that morning we did not even get a moth. Under cow-dung on the plain two specimens of a new Dung-Beetle were found, (?) *Eratognathus natalensis*, Péring., and under stones, chiefly on the hill, we found an *Omostropus*, which Mr. Péringuey says is also new; an immature Bug and sundry Ants, to wit, the small *Pheidole irritans*, of which the workers are very tiny; *P. megacephala*, Fabr., well deserving its name, and the big black *Mesoponera caffraria*, Smith; also a *Blatta* sp., and an Ant-lion. Near the top of the hill a large family of the Cockroach, *Deropeltis erythrocephala*, was found under a stone.

Under stones in and among the Boer trenches a number of large Scorpions were found, olive-coloured, with testaceous rings, the large joint of the chelae and tip of the tail pale testaceous, paler beneath. Other dwellers under stones were very young Snakes, a nearly globular Toad which squeaked piteously when taken up, and a Gecko. The last (*Pachydactylus maculatus*, A. Smith) was a sluggish animal with large eyes, doubtless correlated with nocturnal habits. Its body was dull pale brown, with a conspicuous row of dark brown spots on either side of the back, outlined with black and outside that with

pale ashy; belly flesh-colour. When chloroformed, the short stumpy tail was cast off (causing slight haemorrhage), and took much longer to die than the body, wriggling with an apparently spiral movement. Professor Poulton believes that the vitality and activity of the tails of lizards after they have been cast off are an adaptation for the purpose of distracting the attention of a pursuing enemy. Professor W. A. Herdman, F.R.S., suggested that the persistence of the movements of the tail in this instance was due to the fact that the amputated part had lost its connection with the respiratory and circulatory organs, by means of which the chloroform is conveyed to the tissues. Professor Herdman's explanation is doubtless the correct one and tallies with the fact that active insects, such as Humble-bees, succumb much more rapidly to volatile poisons than do more sluggish beetles of the same size. At the time, however, I connected the greater activity of the tail in the killing-bottle with the absence of a brain.[1]

A drive to Hart's Hill in the afternoon made us realize completely what is meant by "carriage exercise," for the road is probably the worst that we ever traversed. It proved more interesting from the point of view of Military History than that of Entomology, nevertheless at the bottom of the hill we kicked up *Sterrha lineata*, Warr., a brownish Geometer; on the slopes, we took under stones *Harpalus capicola*, Dej., ♂; *Paederus crassus*, Boh.; a Staphylinid represented in the General Collection at South Kensington and in the Sharp Collection, but in both unnamed; the big Ant *Acantholepis vestita*, Smith; the tiny *Pheidole irritans*, and *Tetramorium solidum*, Emery.

Here I got a couple of Snails, the handsome, shiny, yellow-green and brown *Achatina simplex*, Smith.

On the summit of the hill, in an old Boer trench, looking down over the slopes on which many a brave soldier breathed his last, was *Pyrameis cardui*, the only butterfly that we saw that day. It may be remarked that it was bitterly cold when we reached Ladysmith a little before midnight.

LADYSMITH, lat. 28° 38′, 3300 ft., August 25, 1905.—The next day was devoted to Spion Kop, and naturally enough disputed questions of strategy and tactics diverted our attention from insect hunting. We had a perfect day for the enjoyment of the glorious view, we had also the advantage of the company of a Sapper Captain to assist in the interpretation of the *Times' History* map of the battle. We realized how the hill was the key to the position, and

[1] *Journal of the Linnean Society, Zoology*, vol. xxx., 1907, p. 48.

looked upon the wide and open road to Ladysmith by which we had driven to the foot of the reverse slope of the famous hill. On Aloe Knoll we saw the pit made by one of the shells from the naval six-inch guns just before the sailors were ordered to cease fire.

A specimen of *Precis sesamus* was taken close to a Boer's grave near the farmhouse below the Aloe Knoll, while a conspicuous Larentiid, *Ortholitha pudicata*, Walk., with reddish fore-wings and orange hind-wings, was netted on the top of the Knoll. The Beetle *Zophosis caffer*, Deyr., was found just below, running on the path. A small Grasshopper was brought from the summit of Spion Kop, and a larger species from the lower slopes on the north side; this last was coloured like dead grass on the exposed portions, but the lower surface of the abdomen and the lower edges of the femora were of a deep bright red. On the road back to Ladysmith, near the half-way house, the conspicuous *Graphipterus cordiger*, Klug, was taken under a stone, as well as the obscure *Zophosis caffer*.

August 26, 1905.—On our walk out to Waggon Hill and Caesar's Camp we found under a stone on the open veldt a Carabid, *Polyhirma notata*, Perond.; when touched it emitted from its mouth a quantity of dark brown fluid having no perceptible odour. Under another stone were two somewhat remarkable Toads; their olive-green colour being relieved by dull vermilion markings on the top of the head, sides of the back and upper surface of the legs. They were also adorned with a dark Y-shaped mark on the back of the head, and a dark spot on either side of the middle of the back. The dingy Boarmiid *Semiothisa brongusaria*, Walk., was common on rough bushy ground.

The famous work at the western end of Waggon Hill was garrisoned by *Precis sesamus*, while the variable Geometer *Tephrina catalaunaria*, Guen., was taken close to the Earl of Ava's grave. Within the trenches of Caesar's Camp we took the Geometer, *Tephrina arenosa*, as well as two Acridians.

Returning to Ladysmith we found on the northern (reverse) slope of Caesar's Camp, under large stones near the head of the then dry spruit, the curious Cockroach, *Derocalymma porcellio*, Gerst. (*intermedia*, Kirby). It is remarkably flat and sits closely appressed to the stones; it appeared to be extremely local. Between this point and the bridge over the Klip River just outside the town we found insects much commoner. The scrub is intersected with deep gullies, for the most part dry, but evidently conveying at some time much water to the Klip; in these gullies *Precis cebrene* and *P. sesamus* were not uncommon, also *Synchloë hellica*, of which a male and four females

were taken. *P. sesamus* was fond of collecting into little companies of three to five in narrow and somewhat dark dongas, apparently seeking shelter from the high wind; it oriented fairly accurately; and when settled with expanded wings closely appressed to the very dark coloured shale, it was by no means conspicuous. A male of *Colias electra,* and a female of *Teracolus eris,* Klug, were taken near the river. Single examples of *Yphthima asterope,* Klug, *Zizera lysimon,* and *Tarucus sybaris,* Hopff., ♀, were secured, while other Lycaenids were seen, as also *Pyrameis cardui* and *Danaida chrysippus.*

A specimen of the handsome Quadrifid Noctua, *Acanthonyx praetoriae,* Dist., was taken resting in the dry bed of a spruit; the nebulous Boarmiid, *Osteodes turbulenta* and other Geometers were kicked up, including a beautiful green one (with somewhat the look of *Euchloris vernaria,* Hübn.) which got away into the undergrowth. An Ichneumon-fly and a common Honey-bee were also taken. A small Bug, *Pododus* sp. (not in the National Collection), was seen running on the sand; on being pinned it exhaled a strong odour of acetate of amyl. The Beetle *Zophosis caffer* while running swiftly on the sand was occasionally blown over by the wind.

The electric lights about the town and railway-station attracted a fair number of insects, the commonest being the large flying Ant, *Dorylus helvolus,* Linn., ♂, a yellowish-brown insect with very flexible abdomen; its position in the insect world was at the time a puzzle to us. When pinned the thorax cracked and emitted a puff of white powder. The largest insect at light was the Lamellicorn, *Oryctes boaz,* Fabr., a rotten-wood feeder, of which two were taken. With these were the Noctuids *Audea variegata,* Hmpsn., *Leucania (Borolia) melianoides,* Möschl., *Homoptera canescens,* Walk.; the Syntomid, *Thyretes caffra,* Wallgr., ♂; three Phycids: *Microthrix inconspicuella,* Rag., one, and *M. insulsella,* Rag., two, and several other moths not yet named.

Two moths, *Plusia limbirena,* Guen., and a Micro, were taken in the bedroom of the hotel.

August 27, 1905.—An afternoon was spent on the north-eastern defences, The King's Post, and The Devons' Post, which were on low rocky hills with a little small scrub. At the latter, which runs out towards Lombard's Kop, exposed to the cross-fire of two "Long Toms," the works were more solid and better built than any that we came across, whether built by Boers or Britons, and showed pretty plainly that there must have been skilful wallers among the Men of Devon. Single specimens of *Precis archesia,* the semi-transparent

Acraea neobule, Dbl. & H., and *Byblia ilithyia*, were taken at the King's Post, but the commonest butterfly there was *Pyrameis cardui*, for the most part small and rather worn specimens; flying with it was *Utetheisa pulchella*. Lizards were numerous, but although Dr. Dixey spent some time in watching them, they were not seen to make any attacks on butterflies.

At the Devons' Post *Synchloë hellica, Pyrameis cardui, Precis cebrene*, and *Zizera lysimon* were taken. Alongside a stream separating the two hills *Yphthima asterope* was rather common, looking not unlike a Blue on the wing; futile attempts were made to see the butterfly settle, but it was restless. At the flowers of *Aloë (?) ferox* were *Xylocopa hottentota*, Smith, ♀, the Wasps *Belonogaster distinguendus*, Kohl, 3 ☿, and *Eumenes dimidiatipennis*, Sauss., ♀, a large red and black, brown-winged insect; the Phytophagid *Ortalia pallens*, Muls., was taken flying near the same flowers.

Anywhere along the ridge that strange Grasshopper, *Phymateus leprosus*, Serv., might be seen. This is of a grey- or yellowish-green, tinted with yellow, orange, and pink; its hard thorax, though strongly tuberculate, shines with an enamel-like texture. It is very sluggish, and unlike most of its tribe does not readily take flight, but when it does so makes a rattling noise. When touched it emits copiously a dark olive-green, very fetid fluid, which dries up as a sticky varnish readily soluble in water; this, accidentally tasted, was found to be bitter and extremely unpleasant. [See Plate II., Fig. 7.]

I suppose there never were battlefields where so few relics are to be found. An occasional shrapnel bullet, or fragment of shell, is all that is to be seen. The Kaffirs have made a clean sweep of the country. I once happened on a water-bottle. Owing to the marvellous climate in some places preserved-meat tins (where not scratched) were still, after three years, as brilliant as silver.

August 28, 1905.—At Ingagane Station, lat. 27° 56′ S., alt. 3900 ft., a specimen of the Geodephagous beetle, *Acupalpus natalicus*, Péring., was found under a lump of hard earth.

At Newcastle, lat. 27° 48′ S., alt. 3900 ft., a specimen of *Precis sesamus* was found in a tiny dark kloof; its love of darkness was also noted on subsequent occasions. Several Acridians, whose determination is postponed, were taken. An immature Cockroach was found under a flat piece of iron, together with a community of the Ant, *Acantholepis vestita*. The Heteromerous beetle *Zophosis caffer* was caught running swiftly over sand.

At Inkwelo, under the shadow of Amajuba (lat. 27° 32′ S., about 4500 ft. above the sea), a Fly, *Sarcophaga* sp., was taken, but on this

day at these altitudes the conditions were decidedly wintry, and the night of August 28th was cold.

JOHANNESBURG, TRANSVAAL, lat. 26° 10′ S., alt. 5700 ft.

Aug. 30th—Sept. 2nd.

The weather during our short stay was chilly and almost sunless, while the time available only permitted of two short afternoon walks in the outskirts just beyond West Cliff.

But three butterflies were seen, *Pyrameis cardui*; *Papilio demodocus*; and the Skipper *Parnara ayresii*, Trim., a species that does not appear to be widely spread. Moths were about as poorly represented by the cosmopolitan *Nomophila noctuella*, by *Sterrha sacraria*, of the dingy South African form, lacking the crimson colour, and by that obscure Phycid, the almost cosmopolitan *Etiella zinckenella*, Treit. Thus four out of the six Lepidoptera were denizens of Europe as well as South Africa.

The most promising mode of collecting appeared to be turning over stones, old tins, etc., on the veldt; this back-aching process yielded Ants in great plenty, the commonest species being the big-headed *Camponotus marginatus*, Latr., which turned up in this locality only; it is a very shiny insect, intensely black, but with red legs and antennae. Close by, the more generally distributed *C. maculatus* was found, while the long black *Plectroctena caffra*, Spin., the smaller *Pheidole megacephala*, and two *Cremastogaster sordidula*, Nyl., var., were also met with. There were in addition to the Ants plenty of Termites. Indeed the great abundance of both Ants and Termites is the most striking point in the South African insect fauna. When I asked local people what was the food of the ants the reply was, Termites. What, then, did the Termites eat? My conjecture was that they lived upon the *roots* of plants which did not show above ground during the dry season.

The beetles included several Carabids, viz.: *Chlaenius sellatus*, Dej., two; another *Chlaenius* that may possibly be new; *Harpalus deceptor*, Péring., nine specimens; *H. angustipennis*, Boh., two; *Macrocheilus dorsalis*, Klug, one; *Trechus rufipes*, Boh., one; then there were two of a *Trigonopus* that may possibly be new; the very distinctly marked *Graphipterus cordiger*; an *Opatrum* that is probably *arenarium*, six specimens; an unnamed *Psaryphis*; a Lamellicorn of the genus *Aphodius* that is not represented in the National Collection; two Weevils, *Hipporhinus corniculatus*, Fåhr.; and *Brachycerus severus*,

Fåhr.; also a Lady-bird, *Exochomus nigromaculatus*, Göze, which is occasionally found in Britain.

Under stones were two Pentatomid bugs, *Dalsira modesta*, Fabr., and the lance-head-shaped *Gonopsis angularis*, Dall., also *Lygaeus rivularis*, Germ.; there were also several other bugs that are not yet named. Along with the bugs were several Cockroaches and a black and red Scorpion. Two specimens of *Acridium pardalinum*, Walk., and a number of as yet undetermined Acridians were also taken.

The most interesting insect met with at Johannesburg was a Homopteron, *Gyaria walkeri*, Stål, allied to *Flata*, a genus well known from its alleged resemblance when at rest to a spike of flowers. It is of a creamy-white colour with eyes of a beautiful pinkish hue, that is unfortunately soon lost after death by cyanide. The insects are gregarious, and sit in rows of from three to five each near the *base* of the stems of a shrubby herb which attains the height of about two feet. Sitting for the most part with their heads up, they cannot be said to look in the least like flowers; immature specimens look more like a *Coccus*, or even a luxuriant growth of *Penicillium*. When a plant harbouring the *Gyariae* is approached the insects jump off and fly away a short distance much like moths. They were only found within a very circumscribed area.[1]

Settled on rocks basking in what little sun was to be had several Flies were captured, all males, of a species of *Dichaetometopia* allied to *tessellata*, Macq., but probably new to science.

PRETORIA, TRANSVAAL, lat. 25° 53′, alt. 4500 ft.

August 31st.

The British Association paid a mere flying visit to the political capital, but this just permitted a carriage-drive to the Wonderboom, a singular tree of wide-spreading growth, which stands at the foot of the northern slope of a range of hills about 3½ miles to the north of the city. So far as results were concerned the time and trouble, and more particularly the dust, might as well have been spared. Insects were very scarce save at the sweet-scented white flowers of *Dombeya densiflora* [Nat. Ord. *Sterculiaceae*] which proved very attractive. There was, however, an incommensurability between the height of the trees and the length of the net-stick which was tantalizing in the extreme. A few Whites as well as *Danaida chrysippus* and a Lycaenid were seen out of reach. The pedunculated

[1] This paragraph refers to Prof. J. W. Gregory's description and figure in "The Great Rift Valley," London, 1896, pp. 273–5, and Frontispiece. Also to S. L. Hinde in *Trans. Ent. Soc., Lond.*, 1902, p. 695, and Plate xxvi.

Wasp *Belonogaster griseus*, Fabr., was abundant, and four males were with difficulty secured; the South African form of *Apis mellifica* was also busily at work together with two smaller Bees (♀). These last Colonel C. T. Bingham described as a new species under the name of *Ceratina vittata*,[1] *sp. nov.*, so an otherwise disappointing day was redeemed. A specimen of the Chafer *Oxythyrea marginalis*, Schönh., was taken on the lavender flowers of a *Buddleia* [Nat. Ord. *Loganiaceae*] near the river, and close by a single example of the Lycaenid, *Spindasis mozambica*, Bert. On the veldt below the big tree, the common but pretty Grasshopper, *Catantops melanostictus*, was very active and difficult to secure; in the same place we netted two specimens of *Terias brigitta*, a species we had not met with in Natal.

RAILWAY JOURNEY FROM JOHANNESBURG TO KIMBERLEY.

September 4th, 1905.

GLEN SIDING, lat. 28° 55′ S.—On the flowers of a low-growing *Senecio* (not unlike the Oxford *S. squalidus*, Linn.) a Wasp was taken, *Ammophila* (?) *argentea*, Brullé, ♀, which Colonel C. T. Bingham said was not typical, but possibly a local form of the species; with this was a Honey-bee, *Apis adansoni*, ☿. At this place *Pyrameis cardui* and *Colias electra* were noted.

BLOEMFONTEIN, lat. 29° 7′, alt. 4500 ft.—In the station-yard the last-named two butterflies were again seen, and a female *Synchloë hellica* was taken.

NORVAL'S PONT, CAPE COLONY, lat. 30° 38′, alt. 4000 ft.—The cosmopolitan *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.), came to our lights.

COLESBERG JUNCTION, lat. 30° 44′; alt. 4370 ft.—At this station, naturally associated with the exploits of General French, several moths visited the lights of the train. They were the pretty silver-striped Geometer, *Conchia nitidula*, Cram.; an unnamed Noctua; our old friend of many lands, *Nomophila noctuella*; and three Phycids, two of them being the dingy *Microthrix inaulsella*.

During the long railway journeys over the elevated tablelands of the interior, and more especially between the Orange River and Vryburg far north of the Vaal, the train travels for hour after hour over plains at one time rolling, at another level, but the view is almost always broken by the characteristic flat-topped hills or "kopjes" which played such a conspicuous part in the war. They

[1] See footnote, p. 183, *supra*.

are evidently capped by horizontal strata of harder material, I believe in many instances the igneous rock called dolerite. These kopjes are numerous, sometimes forming more or less broken ranges, sometimes groups, but often quite isolated. The impression given to the geologic eye is that their flat tops must once have been united by a continuous sheet of the capping material. The scene at once recalled to my mind the flat-topped hills of the Saxon Switzerland, but the African scene is on a vastly larger scale. A very moderate exercise of the geological imagination serves to explain by the action of existing agencies the excavation of a sinuous cañon such as those of Western North America; or of a "baranco," or "ribeira," cut through the basalts and tuffs of Tenerife or Madeira. Here, however, the flat-topped kopjes differ from the examples quoted, by the distances which separate them; for miles, often many miles, of veldt must be traversed in journeying from one kopje to the next. It is, indeed, the difference between "intaglio" and "relievo." To effect the result the work of denudation must have been on such a vast scale as to baffle the imagination. The existing rivers are few and far between, and all too puny for the task; moreover, the present rainfall does not exceed 25 inches in the year. Can ice conceivably have been the transporting agent? Or are the kopjes the ruins of ancient islands? The plains are now elevated from 2000 to 4000 ft. above sea-level and the distance from the coast is from 200 to 300 miles. Lastly, where has the prodigious amount of material removed been deposited? It is certainly a problem of the first magnitude.

KIMBERLEY, GRIQUALAND WEST, lat. 28° 43′ S., alt. 4010 ft.

September 5th—7th, 1905.

The Diamond City with its white dust (in striking contrast to the red of the Golden City) did not impress us as a good locality; moreover, we had but little spare time, and the weather, for the most part cloudy, was unfavourable.

At KENILWORTH the Weevil *Cleonus mucidus*, Gerst., was beaten from *Senecio*, and two dead Heteromera, *Psammodes* (*Moluris*) *vialis*, Burch. (*pierreti*, Sauss.), and *P. scabricollis*, Gerst., as well as an Earwig were taken under stones. Under one stone a large dark, short-legged Spider with globular abdomen was found in the midst of copious remains of beetles, etc.

On the veldt in the outskirts of the town, beyond the Old Kimberley Mine, the following were found by turning over stones,

old tins, etc.:—The Lamellicorn, *Trox denticulatus*, Oliv.; the Heteromeron, *Psammodes vialis*, two dead specimens; the Weevils, *Brachycerus globosus*, Fabr., one; *Episus bohemani*, Auriv., one; *Sparticerus* sp., four; and *S. rudis*, Fåhr., nine. None of the last three species were represented in the British Museum; for weevils their integuments are but moderately hard, but, on the other hand, in the red sandy soil under the old tins, or among the roots of Composite plants, their rough surface as well as their colour make them difficult to see. Eight specimens of the Carabid, *Baeoglossa melanaria*, Boh., were found in holes in the ground under stones or tins; they ran fast when disturbed. It was noted that under the South African sun even large stones, not to speak of the omnipresent rusty tins, afford so little protection from his rays that frequently insects were found lurking in holes in the earth beneath, so that they were doubtless often passed over. Besides the above beetles the stones and tins harboured a number of the Ant *Monomorium subopacum*, Smith, race *australe*, Emery.

Under a decaying calf's foot and pastern were three specimens of *Necrobia rufipes*, Fabr., a British insect; two of the cosmopolitan *Dermestes vulpinus*, Fabr., and another beetle not yet named. The Fly, *Agria nuba*, Wied., was captured in the same locality.

At the Dutoitspan Mine we saw *Pyrameis cardui*, and took two *Synchloë hellica*, one of each sex, as well as the Grasshopper *Acrotylus* sp. A Longicorn, *Tetradia lophoptera*, Guér., was seen on the wing, it settled on the light grey road of the compound and disappeared, being so exactly the colour of the dust that it was most easily found by feeling with the hand!

A warty, stump-tailed, but active Lizard was found under a stone, when caught it uttered a sound between a squeak and a hiss.

It may seem a somewhat wild statement, but I was much struck by the fact that a Burchell's Zebra in an enclosure near Kenilworth was not nearly as conspicuous on bare ground as the same beast would have been in England, its lighter parts seemed to harmonize wonderfully with the reddish brown soil.

At the Wesselton Mine, on a weedy piece of waste ground, two specimens of a Lycaenid, so worn as to be scarcely recognizable, were netted; also two of a very elegant Bombyliid, *Systoechus* sp., which was only to be discerned on the wing as the light caught its long white pubescence.

A dull, cheerless morning was spent on the golf links in sight of the Memorial to the Honoured Dead. There seemed to be nothing to do but turn over stones, which, though doubtless an annoyance

to the golfers, afforded shelter to a number of Arthropoda. The most interesting beetle was *Graphipterus cordiger*, a quite soft insect of a drab colour bearing upon its elytra a black mark which has been variously compared to a heart, a fiddle, and a tennis-racquet; of this we secured eight examples. Of the Weevil *Sparticerus rudis*, which was very common, we took seven specimens, again noticing its resemblance to the red soil of the veldt. It may be here mentioned that the general colour of the soil at Kimberley, as at Johannesburg, Pretoria, Durban, and indeed most of the places that we visited, is red; the white dust that is so disagreeable in the town is derived from the mining refuse, and a very similar dust is met with near the gold mines of the Rand. Among the common *S. rudis* was found another *Sparticerus* which shammed death, this specimen is not represented in the British Museum collection; we also took two *Episus bohemani*. The *Carabidae* were represented by one *Baeoglossa melanaria*, three *Harpalus hybridus*, Boh., all females, and five *H. affinis*, Péring. Dead examples of the Heteromera, *Psammodes scabricollis* and *P. vialis*, with other remains showed that it was not the season for that genus, and the unearthing of a large beetle-larva pointed to the same conclusion.

With the beetles were several Bugs and an Ant, *Aphaenogaster barbara*, Linn., var. *capensis*, Mayr, accompanied by a number of "silver fish" (*Thysanura*).

RAILWAY JOURNEY FROM KIMBERLEY TO BULAWAYO.

September 7th and 8th, 1905.

TAUNGS, BRITISH BECHUANALAND, lat. 27° 33′ S., alt. 3590 ft.—The very distinct Catocaline Noctua *Chalciope rivulata*, Hmpsn., and a Tinea, not as yet determined, came to light in the train.

MOCHUDI, BECHUANALAND, lat. 24° 22′ S., alt. 3100 ft.—Two flies which would appear to be the too familiar *Musca domestica*, were taken near the station, as well as an obscure beetle found under a stone. It was somewhere near this place that we entered the forest characteristic of this part of Africa, an open or easily penetrable growth, with deciduous trees of moderate size having a curious tendency to be flat-topped, affording a striking contrast to a Canadian forest of pointed firs. An English wood with its round-topped, or dome-shaped trees, is more beautiful than either.

ARTESIA, lat. *circa* 24° S., alt. 3100 ft.—A female of the very African-looking Lycaenid, *Zeritis damarensis*, Trim., as well as a

specimen of the wide-ranging *Polyommatus baeticus*, also a female, were netted. The hasty turning over of a few stones yielded the Pentatomid bug *Diploxys acanthura*, Westw.; four Ants, *Camponotus maculatus*; also a dead Beetle with a very hard carapace, *Anomalipus* sp., represented in the British Museum collection, but without a name; as well as a Weevil, *Sparticerus* sp.

MAHALAPYE, lat. 23° 3′ S., alt. 3300 ft.—Here we entered the tropics, an event that was signalized by the capture of a male *Catopsilia florella*, Fabr., and the determination of its sweet scent.

PALAPYE ROAD STATION, lat. 22° 44′ S., alt. 3010 ft.—The beetle *Xenitenus dilucidus*, Péring., was taken in the train.

SERUI, lat. 22° 27′ S.—While stopping at this station the electric lights of the train attracted a number of insects, among those that were secured were the very small drab Noctua *Eublemma* sp. (near *foedosa*, Guen.); a Quadrifid Noctua, *Homoptera* sp. (which may be new); an Acontiid Noctua, *Arcyophora rhoda*, Hmpsn.; a flying Ant, *Mesoponera caffraria*, a female; and several moths not yet determined.

It was during this journey (? at Francistown) that we were startled by a huge cock Ostrich belonging to the station master which stalked along the train thrusting its hideous head, with those unsympathetic eyes, into the carriage windows, presumably in search of food.

BULAWAYO, SOUTH RHODESIA, lat. 20° 9′ S., alt. 4470 ft.

September 9th—11th, 1905.

The most promising spot near the Matabili Capital was, we were told, the Waterworks situated a few miles to the westward, at an altitude of perhaps 4600 ft. Here we came across two shrubs in full flower, which proved very attractive to insects: one with white sweet-scented flowers, *Dombeya* (?) *rotundifolia*, Harv., was frequented by *Acraea doubledayi*, Guér., though these butterflies seemed shy of actually settling upon the flowers. Altogether we took seven specimens, three of them about the *Dombeya*. On these flowers we also took the slender Scoliid *Myzine capitata*, Smith, ♂, and the long-bodied wasp *Belonogaster griseus*, ☿; there were also two beetles of the genus *Mylabris* (or perhaps *Ceroctis*), a Cantharid of very similar colouring to the Longicorn *Hylomela sexpunctata*, Fabr., a species that we met with at Ladysmith and East London, but not nearer. Two of the Cetoniid, *Rhabdotis* (*Pachnoda*) *sobrina*, Gory & P., were also taken on the *Dombeya*; it is an active insect easily alarmed

and taking flight. This dark olive-brown beetle is less conspicuous on the white flower than might be expected owing to the small white spots, with which it is relieved, breaking up the mass of its ground-colour. I should be quite prepared to learn that *Macroma cognata*, a beautiful chocolate-brown and canary-yellow Cetoniid, that we took on the wing at Durban and East London—where in truth it was obvious enough—finds concealment when on an appropriate background, by the broken pattern on its back. Another entomologist had discovered the attractive powers of the *Dombeya* before we did —the yellowish-grey, yellow-marked *Chamaeleon dilepis*, Leach, ♀; it was surprising that so large an animal could be so inconspicuous.

The other flowering shrub was a species of *Combretum* [Nat. Ord. *Combretaceae*], with spikes of yellowish-green flowers having the superficial appearance of catkins. This was especially attractive; it was frequented by *Acraea doubledayi*, but the Lycaenid *Axiocerces harpax* settled on it in large numbers, and seven specimens, five of them males, were secured; they closely resembled when so settled the curiously formed dry seed-vessels of the *Combretum*, of which many remained on the bush.

Other Lycaenids at the same flowers were *Crudaria leroma*, Wallgr., of which only two were obtained, together with single specimens of *Tarucus telicanus*, ♂, and *Aloeides* (?) *taikosama*, Wallgr., ♂. With these butterflies were numbers of other insects, conspicuous among them the bright coral-red Braconid, *Iphiaulax whitei*, its smoky-black wings bearing a scarlet (or yellowish) triangle on the costa, and the large blue-winged pedunculated Wasp *Eumenes dyscheira*, Sauss., var. ♂. Here Dr. Dixey took with the common *Icaria cincta*, ☿, a male of the new species *Myzine rufo-nigra*, Bingh.[1] The Mason-bee *Chalicodoma coelocera*, Smith, ♂, was taken at a flowering shrub, whether *Combretum* or some other is uncertain, but be that as it may, the *Combretum* certainly produced an unnamed Bug and sundry Flies: *Rhynchomyia* sp., *Exoprosopa* sp., and *E.* (?) *lar*, Fabr.

Apart from those found on or about flowers, insects were scarce, and it took a good deal of work to secure the following butterflies:—*Teracolus topha*, a female; *T. antigone*, Boisd., a female which flew slowly near the ground without settling; *T. annae*, a female; *T. achine*, two males, and *Terias brigitta*, a male and two females, the former less "dry" than the latter. Certain dark, yellow-striped Grasshopper larvae were seen on the stems of *Combretum* and other shrubs; they were truly gregarious, and were observed to advance and halt together as if drilled.

[1] See footnote, p. 182, *supra*.

On a stretch of somewhat lower flat country covered with coarse dead grass we saw many individual specimens of the Red Migratory Locust, *Schistocerca peregrina*, Oliv., but no swarms; we spent much time in vainly endeavouring to catch them, for they are extremely wary and took to flight in an exasperating manner when approached within four or five yards. The general colour of the living insect is dark mahogany-red, with some greenish-brown shading, but the wings shine brightly in the sunlight, so that the insects resemble small flying-fish.

On September 10th we had a delightful excursion to The Matopos, a wild group of granitic hills about forty miles to the south-south-west of Bulawayo. The veldt may be from 4500 to 5000 ft. above sea-level, the kopjes rising from 100 to 800 ft. higher. In the wider valleys are stretches of coarse grass, but for the most part the country is covered by somewhat open scrub and forest, not especially tropical in aspect. Some of the hills are wooded, others mere bosses of almost smooth granite. Such a country was most attractive, but the length of the drive to and from the terminus left little time for collecting.

The coach-road passes close by the Zoological Garden, a piece of forest four square miles in area, enclosed by a lofty iron fence. It was most interesting to see a Giraffe browsing on the leaves of a tree, under almost natural conditions.

The commonest butterfly was *Acraea doubledayi*, which was to be seen flying among long grass as well as at the flowers of *Combretum* and *Dombeya*, altogether eight specimens were taken; a single example of *A. calderena*, Hew., was taken among long grass, together with *Yphthima asterope*, var. *norma*, Westw., and the Blue, *Everes cissus*, Godart.

The catkin-like racemes of the shrub *Sclerocarya caffra*, Sond. [Nat. Ord. *Anacardiaceae*], were also very attractive, yielding the Lycaenids *Hypolycaena caeculus*, Hopff., a female, and the very beautiful and distinct *Stugeta bowkeri*, Trim., a male, also the now familiar *Apis adansoni*, ☿; but far more startling than any of these was the beautiful long-beaked Sun-bird with blue throat surmounting a breast of crimson shot with violet (*Nectarinia* (?) *metallica*).

On the branches of the *Sclerocarya* were a number of *Polyrachis schistacea*, Gerst., a dull, black Ant with nearly globular abdomen.

A small tree with sweet-scented, viscid, yellow-green flowers, a species of *Gardenia* [1] [Nat. Ord. *Rubiaceae*], was extremely attractive to insects, and it was interesting to watch the Sphinx *Cephonodes*

[1] Or possibly *Tricalysia jasminiflora*, Hook., of the same Natural Order.

hylas, Linn., hovering amidst the numerous Carpenter-bees, the commonest of which, *Xylocopa caffra*, Linn., ♀, var. *mossambica*, Grib. (with two white rings on the abdomen), it appeared to mimic; of the other species *X. olivacea,* Fabr., and *X. divisa,* var., single examples only were secured, females; the former species is very handsome, its thorax being of a beautiful "old gold" colour. A Bombyliid fly, *Systoechus* sp., as well as a male of *Catopsilia florella* (by no means the only one seen), were taken on the same tree.

The *Combretum* attracted besides *Acraea doubledayi*, the Lycaenid *Axiocerces harpax*, a male, and the fine Wasp *Belonogaster griseus*, ☿, which has a conspicuous yellow spot on the side of the abdomen, also a number of the brilliantly-coloured Braconid *Iphiaulax whitei.* On the same plant was found a Lady-bird, *Chilomenes* sp., which is in the National Collection, but without a name.

On *Dombeya* flowers, besides Ants, three specimens of the Cetoniid *Rhabdotis sobrina* were taken.

Certain Aculeates were taken at flowers of one sort or another, which it is not now possible to distinguish :—*Belonogaster guerini,* Sauss., ☿, var. *dubius,* Kohl, *Elis* (*Dielis*) *fasciatella,* ♂; also the long-waisted, black, red and yellow wasp, *Eumenes lucasia*, Sauss., ♀. This last was the third specimen known to Colonel C. T. Bingham, the type being at Paris and the co-type in the British Museum, from Bab-el-Mandeb (2500 miles away). Lastly, a small slender, black, white-ringed solitary wasp, a female of a new species of *Labus,* said by the late Colonel Bingham to come very near the Javan species that is the type of the genus. It would appear to be the first notice of this genus in Africa. Colonel Bingham described this as *Labus ravus, sp. nov. in MS.*; but before his paper was published Mr. Geoffrey Meade-Waldo described a specimen from Natal as *L. annulatus, sp. nov.*[1]

Other things that were picked up on that memorable day were a worn specimen of the pale fawn-coloured *Mycalesis simonsi,* Butl., one of two or three that were seen at one partially shady spot; a large "dry" *Terias brigitta,* ♀; a *Tryxalis* sp.; a fly, *Anthrax* sp.; and a beetle, *Zophosis angusticollis,* Deyr., found running rapidly over the ground at the World's View, close to the grave of Cecil Rhodes.

The account of the expedition would not be complete without mention of the swarms of the Red Locust, *Schistocerca peregrina,* which during the drive back to the train rose in glittering clouds on every side. It was, however, not without repeated efforts that a few specimens were netted out of the many thousands seen.

[1] *Ann. Mag. Nat. Hist.*, (5), viii. p. 86, 1910.

In the town of BULAWAYO, *Zophosis caffer* was taken running over the ground, while by turning over stones many things were obtained, including the curious hairy beetle, a Heteromeron, *Usagaria australis*, Péring., four specimens; *Psaryphis* sp., which was not represented in the British Museum; the Geodephagid, *Omostropus consanguineus*, Péring., three; the Staphylinid, *Myrmedonia procax*, Péring.; a Weevil; and the obscure little Bug, *Pododus depressus*, Walk.

About the filter-beds near the railway station the Lycaenids *Zizera lysimon*, one, and *Aloëides taikosama*, two males, were taken.

The two beetles, *Meligethes* sp. and *Pseudo-colaspis* sp. (the last is represented in the National Collection but unnamed), and the small dingy bug *Agonoscelis puberula*, Stål, were taken either at or near Bulawayo, or at the Matopos; the beetle *Pogonobasis* sp. (unnamed in the British Museum) was taken somewhere in South Rhodesia prior to our arrival at the Falls, but the locality cannot be now designated, for the notes concerning these insects are unfortunately defective.

I have mentioned the finding of two Chamaeleons. This place will be as convenient as any to describe my observations on the living animals.

CHAMAELEON PUMILUS, *Daudin*. My specimen, a female, was taken on a shrub, about 4 feet from the ground, in the Botanical Gardens, Cape Town, August 9th, 1905.

Description.—Apple-green; at the back of the eye two patches of greyish-pink placed vertically; a lateral stripe of the same colour extending from shoulder to pelvis, widest in middle, where are two dark grey spots. Several orange tubercles on the back. Belly striped with greenish white; underside of head striped blue-green and pink. The ground colour varies to dusky green.

It was kept in confinement and the following observations were made at Durban, August 16th, 1905. After it had been kept for some time in the dark it became of the brightest apple-green. On exposure to light it forthwith darkened. Placed on a dark tin case near the window in bright light it darkened *along the dorsal area.*

It was taken out into the garden and placed alternately on a black pair of trousers and on a white towel. It darkened in both cases, but there was no noticeable difference. When put on a twig of a shrub with bright green leaves it became paler. The side *away from the sun* was of the brightest apple-green, the side exposed to the sun became *darker along the back.* The bright green harmonized wonderfully with the young leaves, the creature appeared *flat*, and was scarcely

distinguishable. The neck and belly did not appear to change colour.

It was then killed, being rapidly overcome by chloroform, then becoming more dusky than I had seen it previously: that is to say it assumed its *darkest* coloration.

CHAMAELEON DILEPIS, *Leach.* The animal, a female, was taken near the Waterworks, Bulawayo, September 9th, 1905 (about 3 to 4 feet from the ground), on a shrub of *Dombeya* (?) *rotundifolia*, the white flowers of which were attracting a number of insects of various orders. I was startled on detecting the animal, which at first escaped my notice.

Description.—Pale yellowish-grey, legs and tail darker; streaked and blotched with greenish-grey. Throat with six cadmium-yellow stripes. A yellow spot behind the shoulder, another over the ribs, and a yellow lateral line.

It gave vent to a gurgling hiss when disturbed, and once bit me, but not hard enough to hurt.

It was kept alive and observed at Victoria Falls, September 16th, 1905. Placed on a plant of young Acacia, the animal soon lost all its darker bands and became almost uniform grey-green, with the above yellow markings. In the sun it became strongly mottled, with some tendency to be paler on the shady side, but this was not very marked. Its excrement consisted of elytra and other insect-fragments.

When chloroformed, it became a uniform pale yellowish colour, a little paler than my khaki coat; that is to say, assumed its *palest* coloration.

The moment that I saw the green Chamaeleon turn dark on the side towards the sun (a quite unexpected phenomenon) Mr. Abbott H. Thayer's model of the Wild-duck in the Oxford Museum came to my mind. Here, I thought, was a striking instance of the principle of counter-shading, whereby shadow is annihilated and with it the conception of solidity.

The dissimilar action of chloroform on the two reptiles is remarkable. If it be assumed (as seems likely) that the darkening of the green chamaeleon was paralytic, then the blanching of the grey chamaeleon must have been the result of stimulation, or *vice versâ.*[1]

[1] These observations, together with others of his own, generally concordant with mine, were communicated to the Linnean Society by Professor E. B. Poulton, F.R.S. *Journal Linnean Society, Zoology*, vol. xxx., 1907, pp. 45–48.

THE RAILWAY JOURNEY FROM BULAWAYO TO THE VICTORIA FALLS.

September 11th, 1905.

RED BANK STATION (19 miles from Bulawayo).—We took alongside the train *Teracolus achine*, Cram., a male; *T. antigone*, a male; and two fine specimens of *Papilio angolanus*, Göze (? *corinneus*, Bert.), which had probably been disturbed from the drippings of the water-tank.

SAW-MILLS STATION, near Umguzi (57 miles from Bulawayo).—A male of *Belenois mesentina*, Cram., was netted, also a Noctua flying in the sun. The Red Locust, *Schistocerca peregrina*, was abundant; by great exertions we succeeded in catching two.

GWAAI (89 miles from Bulawayo), lat. 19° 7′ S., alt. 3240 ft.—Towards evening the train stopped in a stretch of flat, bare country beside a reedy pond to take in water. A fine specimen of *Charaxes saturnus*, Butl. (the only one we saw in our travels), was taken flying about a low tree by Dr. Dixey. We also took the brilliant cardinal-red Dragon-fly, *Crocothemis erythraea*, Brullé. Sweeping the rank vegetation by the pond yielded a multitude of small insects, amongst them a number of the singular Fly, *Diopsis affinis*, Adams, which carries its eyes and antennae upon long rigid stalks or horns projecting on either side of the head. [See Plate II., Fig. 5.] The appearance of these little black and red flies forcibly suggests a Watkin Range Finder in miniature, the eyes being so far separated as to afford an appreciable base-line; if the insect were resting on the underside of a stalk it would be able to see its enemies or prey above it without exposing itself. With the *Diopsis* were *Musca* (?) *domestica*, *Sepedon* sp. and other small flies; two small Scoliids, *Myzine* sp., in too bad condition to name; and other insects, including the Phytophaga, *Haltica pyritosa*, Erichs.; *Hispa spinulosa*, Boh. *nec* Schönh.; *Chaetocnema* sp.; two specimens of the Acridian, *Paratettix scaber*, Thunb., and a small moth, *Eretmocera derogatella*, Walk.

An unnamed Geometer, the cosmopolitan Tineid, *Plutella maculipennis*, and the Cockroach, *Paraplecta pallipes*, Stål, all came to light in the train on the night of September 11th between Gwaai and Wankie. Mr. Shelford says that the *Paraplecta* was first received from Damaraland, but is very rare in collections.

THE VICTORIA FALLS OF THE ZAMBESI, lat. 18° S., alt. 3000 ft.

September 12th–19th.

This, our furthest point, was the locality from which we expected most. Apart altogether from the magnificence of the Falls themselves and the geological puzzles that they afford, the locality presents certain peculiarities to the botanist and entomologist.

Picture a rolling sandy plateau a little over 3000 ft. above sea-level. Low distant hills bound the view, though the characteristic South African flat-topped kopje is for once absent. Above the Falls the banks of the Zambesi are low and almost flat, the country on either side of the river resembling much of that passed through in the railway journey from Bulawayo. The forests of South Rhodesia are chiefly composed of deciduous trees of moderate size, for the most part tending to be flat-topped and so harmonizing with the horizontal strata and giving the landscape a character of its own. The undergrowth of scrub is, as a rule, scanty and easily traversed, while the coarse grass and other herbage is so sparse as to leave much burning sand bare; though it must be borne in mind that our visit was towards the end of a very dry season. Doubtless during the rains much of this sand would be covered with vegetation and gay with flowers, but as it was we found loose dry sand extending to within a very few feet of the *Papyrus* growing at the water's edge. The banks above the Falls are fringed with a narrow belt of shady wood in which (especially on the right bank) the small date-palm, *Phoenix reclinata*, is the prevailing tree, and a shrubby *Ipomoea* was at the time of our visit the most striking flower. Here and there towered the monstrous Baobab tree, *Adansonia digitata*, with stem like an inverted carrot. The first leaves on the commoner forest trees spread an emerald tint suggestive of spring and affording a refreshing contrast to the parched herbage and scorching sand.

Opposite to the Falls is the Rain Forest, poetically called by the Barotse, "The place where the rain is born." This stretches along the cleft for three-quarters of a mile, not counting the similar growths on the Knife-Edge. Between the Rain Forest proper and the edge of the chasm, where the spray is most drenching, is a strip of coarse boggy grass and herbage looking for all the world like a bit of Exmoor into which the bright blue flowers of *Lobelia erinus* have escaped from some parterre. The forest proper, from 50 to perhaps 300 yards wide, is of varied growth, in which large specimens of *Ficus* with their characteristic fluted stems are a prominent feature;

but towards the Falls it is bounded by a dense hedge of very bright green trees, *Eugenia cordata*, an evergreen of the myrtle tribe.[1] The amount of spray, or "Rain," naturally varies with the height of the water and the force and direction of the wind. A sound that one soon learns to associate with the ceaseless roar of the cataract and the pattering of the spray-drops on the forest leaves is the musical cry of the Emerald-spotted Dove (*Chalcopelia afra*).

We saw the Falls at a period of low water, this of course detracts from their grandeur, and, what is more, from their characteristic mystery, for the shrinking of the spray columns enables one to see the chasm better and so better comprehend its weird topography. But though the most absorbed collector cannot fail to be impressed by such unwonted surroundings, this is not the place to dwell upon the majesty of the Falls themselves, or the airy beauty of the brilliant rainbows that attend them by day or their more ghostly representatives in the moonlight.

Two pre-eminent impressions remain graven upon the memory:—a vast river over a mile in width, dotted with wooded islets, glides noiselessly through the burning sand, coming one knows not whence; and again the same mighty river, with scarce a warning rapid or even swirl upon its peaceful waters, suddenly draws a veil of spray over its face as with a mighty roar it flings itself down 350 feet into a chasm athwart its channel, and emerging thence, one can scarce see how, pursues its long mysterious course between grim basaltic crags through the incredible zigzags of the Batoka.

The hotel is situated close to the railway station, in the open forest, about a mile from the Falls, and perhaps 100 ft. above them, though geographically speaking below. The first insect to attract notice was a large *Acraea* flying about the tops of the trees, occasionally as many as a dozen together. After the exercise of some patience a fair series of specimens and a stiff neck were secured. These butterflies proved to be very beautiful, with pinkish fore-wings and white hind-wings; they were new to Mr. Marshall, but previously known to Mr. Trimen by two specimens only, and then considered by him to be a variety of *A. anemosa*, Hew., to which Aurivillius gave the name of *alboradiata*. A long series amply proves this form to be a new species, which should consequently bear the name given to the supposed variety by Aurivillius. If, tired of gazing up at these beauties, the eyes were turned with relief to the ground, Ants might

[1] For an excellent account of the botany of Southern Rhodesia, with a good description of the Matopo Hills and the country about the Falls, see a paper by Miss L. S. Gibbs, F.L.S., *Journ. Linnean Soc., Botany*, vol. xxxvii., 1906, pp. 425–494.

be seen running swiftly over the sand with their abdomina borne high in the air. They were *Camponotus fulvopilosus*, De Geer, dull grey-black with pale brown hairy abdomen, very cryptic in their sandy home. The "soldiers" have such disproportionately big heads as to suggest drummer-boys in bear-skins. The species was common about the hotel and on the way to the Falls. Also running swiftly over the sand a small Beetle was taken, a *Zophosis* not in the National Collection. A flowering tree close to the hotel produced the widely spread *Apis mellifica*, race *adansoni*, as well as two other Bees not yet determined.

The irrigated kitchen-garden of the hotel attracted numerous insects, the most striking being *Acraea atolmis*, Westw., of which about a dozen, all males, were secured; it is a beautiful insect looking blood-red when alive; with them were taken three *A. atergatis*, Westw. (both this and the last-named were, until quite recently, rare insects in collections); three male *A. anemosa*, one of them a dwarf, and two *A. alboradiata*, ♂ and ♀. With the Acraeae were two females of *Terias brigitta*, of the "dry" form, also one *Aphnaeus erikssoni*, Trim. In the same garden were taken the steely-blue-winged Wasp, *Discolia ebenina*, Sauss., four males and a female; also another somewhat fly-like Wasp, the handsome black and yellow *Bembex capicola*, Handl., a male—only the second specimen known to the late Colonel C. T. Bingham, the type being at Vienna.

The electric lights of the hotel attracted a considerable number of insects, but they were for the most part small and insignificant in appearance:—

NOCTUINA.—*Eustrotia* (*Xanthoptera*) *opella*, Swinh., three, a common Indian species. *Homoptera scandatula*, Feld., one, a Catocalid. *Homoptera* (?) *sp. nov.*, one. *Paromphale chionephra*, Hmpsn., *sp. nov.*, two.[1] *Arcyophora* (?) *sp. nov.*, one, an Acontiid not in the British Museum. *Entelia polychorda*, Hmpsn., one, a variable Quadrifid. *Eublemma snelleni*, Wallgrn., a very small Quadrifid.

GEOMETRINA. — *Comibaena leucospilata*, Walk., one: a pretty Emerald.

PYRALINA.—*Argyractis* sp., two. *Stemmatophora chloralis*, Hmpsn. *in MS.*, *sp. nov.*, five: a very distinct and pretty little insect, whitish-green with black central band; its description will shortly be published. [See Plate II., Fig. 9.] *Parthenodes scotalis*, Hmpsn., *sp. nov.*, five: a somewhat dingy Hydrocampid.[2] [Plate II., Fig. 8.] *Platytes sp. nov.*, five: a beautiful Crambid which Sir George F. Hampson has

[1] Hampson, *Ann. Mag. Nat. Hist.* (8) viii. p. 439 (1911).
[2] Hampson, *Ibid.* (7) xviii. p. 470 (1906).

kindly promised to describe. [Plate II., Fig. 10.] *Microthrix insulsella*, two: a dingy Phycid. *Etiella zinckenella*, one: an almost cosmopolitan Phycid. Also several other small moths not yet determined.

NEUROPTERA.—*Nemopistha* (*Halter*) *lancearia*, Navás. Three specimens of this very singular insect came to the lamps; its very long, slender and spirally twisted hind-wings seem to suggest a flying machine rather than an insect.[1] Father L. Navás has recently described this from a fragmentary specimen in the British Museum.[2] [See Plate II., Fig. 2.] (?) *Oestropis* sp., and (?) *Blymorphanismus* sp., two green Trichoptera, together with other Caddis-flies more like European forms.

ORTHOPTERA.—A Cricket.

HEMIPTERA.—*Acanthaspis nugax*, Stål, a Reduviid bug with a peculiar fetor.

COLEOPTERA.—*Apate monacha*, Fabr., two ♀. *Himatismus* sp., three: not in the British Museum. *Trochalus* sp., one: in the National Collection, unnamed. *Xylopertha* sp., one. Two Longicorns, *Plocederus melancholicus*, Gahan, and *Tetradia lophoptera*, Guér. (*fasciaticollis*, Thomps.), also came to light; the latter was captured by one of us on his bed, clinging closely to the sheet, and making a curious creaking noise when disturbed.[3]

Lastly a male *Acraea alboradiata* was taken fluttering on the floor below an electric light at 9 p.m.!

While one of us was busy with the electric lights a waiter excitedly called out that there was a "Tarantula" under the stoep. He was most anxious that it should be secured, but declared that its bite was deadly. It proved very fleet of foot and doubled like a hare; other waiters joined in the chase, which proved most exciting, especially when the spider ran over the neck of the ardent entomologist. When the fierce creature yielded at last to the soothing influence of cyanide it was seen to be of a pale reddish-brown, with pale grey abdomen, but armed with most formidable-looking red-brown mandibles, tipped with black. Black eyes added to its ferocious aspect. Ultimately a second specimen was bottled—together with one of another species.

Above the Falls the RIGHT BANK of the river (here the south-western) was the most readily accessible collecting ground, and perhaps for that reason received an undue amount of attention. There

[1] This was written long before Monoplanes became common objects; but the comparison still seems to me to hold good.

[2] Wytsmann, *Genera Insectorum*, *Nemopteridae*, by the Rev. L. Navás, S.J., 1910.

[3] "The voice no doubt proceeds from the mesonotum."—G. J. Arrow, *in litt.*

on the topi of the captor, and bottled before it pushed the attack home.

Of the Aculeates the most striking were the Carpenter-bees, of which the commonest was *Xylocopa divisa*, found at *Combretum*, or other flowers, though one, a male, was noted as hovering persistently about a tree overhanging the river. The male of this bee is of a beautiful old-gold colour; of this sex only two were taken, but females, of the variety with the band on the back of the thorax white in place of old-gold, were commoner, and four or five specimens were secured. Of *X. caffra*, we took two specimens, both females of the variety *mossambica*, with a white ring in place of the usual two yellow rings. Of *X. olivacea*, we got but a single female. We met with three species of the very slender-waisted Wasps of the genus *Ammophila*, viz.: *A. ludovica*, Smith, a female, and *A. beniniensis*, Beauv., a male, both at wet mud, while a female of *A. ferrugineipes*, Lepel., was taken at flowers. Of the large and handsome black and yellow *Sceliphron spirifex*, Linn., we only secured a single female, also at flowers. Of the long-waisted grey wasp *Belonogaster guerini*, var. *dubius*, a single worker was taken at mud. We also took single examples of *Salius* (*Hemipepsis*) *vindex*, Smith, a male; the Scoliid *Myzine capitata*, a male, and the small red wasp *Odynerus carinulatus*, Sauss., a female, the last-named at wet mud. The integuments of two males of *Rhynchium rupeum*, Sauss., proved of a truly rocky hardness. Running over damp mud three specimens of a notable Ant were taken, *Paltothyreus tarsatus*, Fabr., notable for its powerful bite, but still more for its evil odour, which is extremely strong and pungent, suggesting a mixture of formic acid and bisulphide of carbon.[1] Running along the branches of the tree-*Ipomoea*, near the Leaping Waters, were a number of another ant, *Polyrachis schistacea*, which we had seen at the Matopos on *Sclerocarya caffra*.

The Coleoptera met with were not very numerous, but comprised *Pogonobasis* sp. (in the National Collection, but without a name), which was taken on the ground by Miss L. S. Gibbs; two specimens of *Scymnus* sp.; three Weevils, *Bagous caenosus*, Gyll., which Mr. G. A. K. Marshall had previously seen from Uitenhage, Cape Colony, only; *Rhabdinocerus brachystegiae*, Mrshll. (*in litt.*) and *Xenorrhinus incultus*, Faust, the first specimen of the latter that Mr. Marshall had

[1] For Dr. S. Schönland's observations on the odour of this insect in Bechuanaland, see *Proc. Ent. Soc., Lond.*, 1904, p. xl. He speaks of it as "a stench which comes near that awful stench of the well-known *Caralluma lutea* (an Asclepiad plant) found in the same neighbourhood." The plant, it appears, attracts flies.

seen; also a Eumolpid, *Pseudo-colaspis chrysitis*, Gerst.; and two Heteromera of the genus *Opatrum*, under dead wood. Two specimens of *Adesmia intricata*, Klug, a Heteromeron only represented in the National Collection by specimens from Mozambique, were found crawling on the ground near the Leaping Waters.

The Red Locust, *Schistocerca peregrina*, was by far the most common and most conspicuous of the Orthoptera; as usual it was chiefly found among coarse grass, but could not be said to be gregarious.

In shallows in the river just above the Falls, a small banded Water-snail, *Cleopatra morrelli*, Preston, was to be found, together with abundance of a spotted species with sinnated lip, *Melania victoriae*, Dohrn. The former had been first found in the same locality not long before by Mr. Morrell and described as recently as April, 1905, by Mr. H. B. Preston.[1]

The Left Bank of the river differs in character from the right. The ground lies somewhat higher, there is more wood and scrub but less grass and fewer palms. A female *Danaida chrysippus* was seen at water; of the *Acraeae* the commonest was *A. encedon*, males predominating, while single female specimens of *A. atolmis* and *A. anemosa* turned up. *Precis clelia* was fairly common, and *P. sesamus* was seen, as is its wont, fluttering about and settling under the shade of a dark bank.

The Whites were represented among our captures by two male *Belenois gidica*. *Teracoli* were far less common than on the right bank, probably because there was less of the open grassy country in which they delight; single specimens only of *T. omphale*, a male, and *T. eris*, a female, the latter at *Combretum* flowers, were secured. *Terias* was represented by a female *senegalensis*, Boisd., of the usual dry-season form, but also by a male *brigitta*, of distinctly "wet" character—a notable exception among so many very markedly "dry" butterflies.[2] A male and two females of *Catopsilia florella* were secured while feeding on the large-flowered species of *Combretum* that grows in the Zambesi scrub; this butterfly was almost certainly seen more than once on the right bank, but eluded capture, for *Catopsilia* is very swift of flight and hard to net save when busy honey-gathering. *Papilio demodocus* was taken on the Knife Edge near the eastern extremity of the Falls.

Axiocerces amanga, at *Combretum* flowers, *Zizera lysimon*, and

[1] *Proc. Malacological Society of London*, 1905, p. 300.

[2] See Dixey, *Proc. Ent. Soc. Lond.*, 1905, pp. lxi–lxii, and *ibid.* pp. lxvi–lxvii. Compare Chapter X., § 13, *infra*.

Liptena pallida, were the only Lycaenids brought home, the last taken near the top of the Palm Kloof. Between the last-named place and the railway bridge large Libellulid Dragon-flies were especially common and comparatively easy to catch as they hovered over the path head to wind, like hawks. The commonest would appear to be *Pseudo-macromia torrida,* but there was also a species of *Macromia* as well as the slender *Pseudagrion* (?) *deckeni.*

Speaking of the railway bridge, perhaps one may be allowed to congratulate the engineer who designed it (Mr. G. A. Hobson, of the firm of Sir Douglas Fox and Partners) on a structure which seems as well fitted to its position alike in form and colour as such a thing can be; one shudders to think what might have been placed there by less sympathetic hands.

The only Hymenoptera taken on the left bank were two small Bees, one, unnamed, at *Ipomoea,* the other *Podalirius rapidus,* Smith, ♀, hovering at *Combretum* flowers, also the Braconid *Iphiaulax whitei,* and a long-waisted Wasp, *Belonogaster guerini,* var. *dubius,* ☿.

Beetles were few and far between: a *Mylabris* sp. (? *Ceroctis* sp.), found here, as well as on the other bank, in the flowers of *Ipomoea,* appears to mimic the Longicorn *Hylomela sexpunctata,* a beetle that we met with only at East London. In the same flowers was another beetle, a long narrow purple fellow, not yet named.

A Fly, *Haematopota* sp., that attracted my attention by biting my hand, was the only Dipteron taken.

If the left bank yielded us but a small bag it was some considerable consolation, at all events to the fortunate observer, to have had the opportunity of contemplating from a distance of not more than 100 yards a family of Hippopotami disporting themselves in the water.

By the kindness of the Chartered Company's Forester, Mr. C. E. F. Allen, I was enabled to visit with him two of the wooded islands some miles above the Falls. Entomologically the results were disappointing, but here again Hippopotami came to the rescue, for the thicket on one of the islands was traversed in all directions by their paths, while in an open space lay the bleaching bones of one of the uncouth monsters. The ubiquitous *Danaida chrysippus* was represented by a male, but no *Acraea* was taken, and the only Nymphalines were *Precis natalica,* with ocellated underside, and a *Neptis* which eluded capture.

The Common White of these islands was *Belenois severina,* of which five "dry" males were taken; but *B. gidica* was nearly as common, and two of each sex were brought home. All the *gidica*

from the Zambesi were of extreme "dry" type, drier than their congener. No *Terias* were taken and but three *Teracoli*, all males, two of *T. antigone*, one of *evenina*, Wallgr. Of *Eronia leda*, a female of "dry" type was taken. The only Satyrids were four *Yphthima asterope*, var. *norma*. The Lycaenids were even scarcer, as a solitary *Zizera lysimon* was the only Blue.

A Geometer, an Emerald with red chequered fringes, *Comibaena leucospilata*, was the only moth taken, while unfortunately "other orders" would appear to have been even more than ordinarily neglected, as the captures were limited to a single individual of the evil-smelling Ant, *Paltothyreus tarsatus*, and a pretty black and white two-winged Fly, *Tabanus* sp.

Mr. Allen was good enough to give us four insects taken in a druggist's shop at Livingstone, five miles above the Falls; they were two Flies, one of them a large, fierce-looking fellow, *Tabanus* sp., a red-bodied Wasp *Odynerus carinatulus*, ♀, and a Malacoderm beetle, *Melyris nobilis*, Gerst.

The easiest way down to the river at its lower level, below the Falls, is by the gorge known as the PALM KLOOF, which is separated by the Knife Edge from the eastern portion of the chasm. The path leads rapidly down into a wood of singularly tropical aspect, bounded on either hand by walls of basalt, and thence to the water's edge. The collecting ground is very restricted and difficult, being almost co-extensive with the steep path, so that the ratio of things taken to things seen was a low one.

The butterfly that was most characteristic of the Kloof was *Neptis marpessa*, Hopff.; it was distinctly common, and we took it nowhere else. It has the graceful, sailing, *sibylla*-like flight of the genus, but is smaller than the more generally distributed *agatha*. Several males of *Leuceronia thalassina*, Boisd., were seen, all out of reach. They flew rather high, among the tops of the trees, and seemed to avoid the path. *Belenois gidica*, *B. severina*, and the wide-spread *B. mesentina*, were all taken in the Kloof; the latter, a male, flew fast. The path through the dark wood looked the very place for Satyrids, but only three were met with, two *Yphthima asterope*, one typical, the other of the var. *norma*, and a shade-loving *Mycalesis*, of which Mr. Trimen says: "near *campina*, Auriv., also like *anynana*, Butl., but the underside very red." Our old friend *Papilio demodocus* put in an appearance. A small, worn Lycaenid, probably *Cacyreus lingeus*, Cram., a male; a tailed Blue, (?) *Deudorix* sp., ♀, which may possibly be new, and a male *Tarucus telicanus*, represented that group. Three large Geometers, two of them

Conolophia conscitaria, Walk., the third a Thorn not yet determined, were disturbed from the herbage.

The phytophagous Beetle *Monolepta vincta*, Gerst., was abundant by a spring near the bottom of the Kloof, flying in the sun, but might also be taken by sweeping shrubs.

Of all the collecting grounds at the Victoria Falls, we naturally anticipated most from the RAIN FOREST; it was accordingly the first, as it was the last place that we visited. One caution is necessary *in limine:* the area of the forest is so small, and the driest of sandy areas are so near, that it cannot reasonably be expected to yield valuable evidence as to seasonal forms, for a butterfly captured within its ambit may well have gone through all its early stages outside and have merely entered the spray-bedewed area to quench its thirst. Human experience points in this direction; for it is difficult to imagine anything more refreshing than after some hours' collecting in the drouth to get wetted through by the spray, which was truly grateful and comforting—especially in a thirsty land where beer is two shillings a small bottle. Repeated carefully-timed experiments showed that ten minutes in the hot sun and parching wind sufficed to dry one's garments thoroughly. The chief drawback to these natural Rain Baths was the difficulty of manœuvring a sopping net, and the condition of some of the "very dry" *Belenois gidica*, when taken out of the net under such circumstances was deplorable.

One butterfly did not appear to appreciate the delicious smell of the damp vegetation, at all events our old friend *Danaida chrysippus* failed to put in an appearance. The *Acraeae* too were surprisingly scarce, only single examples of *A. alboradiata*, ♀, *A. anemosa*, ♂, and *A. atolmis*, ♀, were taken. Only one *Precis* is recorded, a ragged *natalica*, but *Neptis agatha* was frequently seen sailing about the *Eugenia* trees. *Yphthima itonia* was common enough, a specimen of *Y. asterope*, var. *norma*, was also taken. Another specimen was obtained of the *Mycalesis* (as yet unnamed), taken in the Palm Kloof, also one *M. safitza*. *Belenois severina* was the commonest White; all taken were males; but extremely "dry" specimens of *B. gidica* (males predominating), were fairly common, especially where the spray was heaviest. Three females of *Leuceronia thalassina* were taken, also a female *Glutophrissa saba*, which was so extremely "dry" as to have lost all trace of mimicry of *Deilemera*. Of *Terias senegalensis*, ♀, *T. brigitta*, ♂, and *Teracolus antigone*, ♀, single examples were secured. That only one *Teracolus* was taken is not surprising, since the genus especially haunts open arid places.

Papilio leonidas flew slowly about the *Eugenia*, with the manner of a Danaid, but the model, if such there be, was not seen;[1] four specimens were secured.

One might naturally have expected to find many of the pre-eminently thirsty Blues in the Rain Forest. Accordingly, *Zizera lysimon*, met with occasionally in all the Zambesi hunting grounds, was really common in the Rain Forest only, probably the other places were too dry for it. But of other Lycaenids single examples only were taken, to wit, *Tarucus telicanus*, ♂, *Everes cissus*, and *Catochrysops malathana*, the last-named sitting head downwards.

Somewhat unexpectedly we found Skippers commoner within the range of the spray than outside, the following presenting themselves: *Parnara mathias*, a male and two females; *Gegenes letterstedti*, three; *Parosmodes morantii*, Trim., one, a species represented in the National Collection by a single specimen from Mashonaland presented by Mr. G. A. K. Marshall; and one *Parnara fatuellus*.

It is curious that two Humming-bird Moths of different species were taken close together, and within a minute or two, *Macroglossa trochilus*, Hübn., and *Aellopus commassiae*, Walk. It is also curious that no smaller moths were brought from the Rain Forest. On the other hand Diptera were numerous; of these the most striking were two species of the strange stalk-eyed genus *Diopsis*; one, near to *dubia*, Bigot, was to be got in abundance by sweeping in the drier parts of the Forest, the other Mr. G. H. Verrall[2] thought might be *ichneumonea*, Linnaeus' long-lost type of the genus. Of another fly, distinguished by its apple-green abdomen, *Odontomyia* sp., several were obtained by sweeping in moister places. The same method produced other flies, among them a specimen which Mr. Verrall thought might be a local race of *Syrphus balteatus*, De Geer, also four *Sepedon* sp.

A species of *Plecia*, with a reddish thorax, was flying lazily about the *Eugenia* trees in large numbers, with its legs trailing behind just as *Bibio marci*, Linn., does in English woods in April. Then there was a pretty black and white *Tabanus* sp.; a pair *in cop.* of another *Plecia*; two specimens, a ♂ and a ♀, of an Asilid that is perhaps *Promachus rüppelli*, Liv., but may be new, unfortunately it was taken

[1] Note by Dr. Dixey: In North-East Rhodesia, on the Chambezi, some 700 miles away, it flies with and appears to mimic *Tirumala petiverana*, Dbl. & H. Compare Trimen, "South-African Butterflies," vol. iii., 1889, p. 218. See, however, Chapter X., § 7, *infra*, for Mr. G. A. K. Marshall's remarks on the flight of this *Papilio*.

[2] This genial entomologist died while this was in the press; a great loss to science, a great personal loss to all who knew him.

without prey; a Syrphid, *Helophilus* sp., near to but not identical with *africanus*, Verrall; lastly, something extremely like *Musca domestica*.

As might have been expected Dragon-flies were fairly numerous, prominent amongst them the large and handsome *Pseudo-macromia torrida* flying in the open swampy space between the belt of *Eugenia* trees and the edge of the chasm; other species were *Phyllomacromia trifasciata*, Ramb., and (by sweeping) the Demoiselle, *Brachybasis rhomboidalis*, Beauv., which appears to have a wide distribution in Africa.

Two Wasps were taken, *Eumenes tinctor*, Chrst., and *Ammophila beniniensis*, both females, while sweeping produced an Ichneumon-fly. Ants were represented by a solitary *Camponotus* sp., of which Colonel C. T. Bingham wrote, "New, but as a single specimen I cannot venture to describe it; allied to *C. sericeus*, Fabr."

The Orthoptera if not numerous were variously represented by a *Mantis* larva obtained by sweeping; four Cockroaches of the genus *Ischnoptera, sp. nov.* (near to *bimaculata*, Gerst.), found under stones and running very rapidly away when disturbed; Mr. Shelford has been good enough to describe this as *I. longstaffi*. [Plate II., Fig. 11.] Sweeping yielded also many Grasshoppers, one of which had its head and thorax conspicuously marked by two lateral yellow stripes. *Prototettix impressus*, Stål, was taken on a tree.

When looking for beetles two very active little Bugs were found under stones or leaves, another was adorned with a red abdomen. Sweeping as usual yielded sundry Homoptera. The same operation produced a few Beetles: a *Lagria*, in the collection at South Kensington, but unnamed, of which five specimens were obtained; a single *Cryptocephalus callias*, Suff.; two of the Phytophagid *Lema chalcoptera*, Lac.; six *Haltica indigacea*, Illig.; two *Hispa* sp.; also one *H. bellicosa*, Guér., of which the National Collection has specimens from the Gold Coast only. Lastly, three Staphylinids, *Osorius rugiceps*, Boh., were found under dead wood.

In such a spot it was but seemly to find an Amphibian, accordingly we may note that a toad-like Frog was abundant among the marshy spray-drenched grass between the Rain Forest and the Chasm. Many of them were extremely small, hardly larger than blue-bottles. A large specimen evacuated a mass of elytra, etc., of small beetles, apparently mostly geodephagous but some perhaps phytophagous; this was interesting, in so far as it bore out our experience that the Coleoptera of the Forest were very small.

Three species of Land Snails were found in the Rain Forest; two

turreted forms, *Opeas octona*, Chem., and the transparent *O. mamillata*, Craven, both under stones, both gregarious. Sweeping grass yielded the delicate, transparent, horny *Succinea* (?) *badia*, Mor., very near to the British *S. putris*, Linn. A Barotse boy, a servant to Mr. Allen, collected for me a number of the dull-looking *Paludina capillata*, Frauen., but exactly where he found them is not on record.

INSECTS TAKEN ON THE RAILWAY JOURNEY FROM THE VICTORIA FALLS TO EAST LONDON.

September 20, 1905.—Matetsi Station, 230 miles from Bulawayo. *Precis cebrene*, seen. *Castalius hintza*, Trim., a male. *Pseudagrion* (?) *deckeni*, a small Dragon-fly, the colour of dead grass.

Katuna Station. *Precis cebrene*, one female.

North of Deka Station. *Glyphodes* (*Dysallacta*) *negatalis*, Walk., a Pyrale of very wide distribution, taken in the train by Mr. D. Gunn.

Deka Station. *Danaida chrysippus*, a female. *Lycaena osiris*, Hopff., a male at water. *Catochrysops asopus*, a male, also at water. *Eumenes lepeletieri*, Sauss., a female at water; this is a yellow Wasp with a conspicuous black cross on the abdomen.

Wankie Station, 212 miles from Bulawayo, alt. 2450 ft. *Teracolus antigone*, a male.

Lukosi Station, 196 miles from Bulawayo. A Carabid beetle, *Anisodactylus nitens*, Péring., under a stone.

Inyantue Station, 177 miles from Bulawayo. *Sphingomorpha chlorea*, Cram., a Quadrifid Noctua that truly deserves its generic name, caught at light in the train by Mr. D. Gunn. It is widely distributed in India and Africa.

S. of Inyantue. A Dipteron, *Argyramoeba* sp., in the British Museum, unnamed.

Malindi Station, 147 miles from Bulawayo. An Ant-lion, *Myrmeleon* sp., at light in the train.

September 21, 1905.—Bulawayo, lat. 20° 9′ S., alt. 4470 ft., near the railway station. *Acraea doubledayi*; also the widely-distributed Lady-bird, *Exochomus nigromaculatus*, a Bug, and some unnamed Orthoptera, all taken by sweeping.

Plumtree Station, S. Rhodesia, alt. 4560 ft., 65 miles S. of Bulawayo. *Acraea doubledayi*, a female, fluttering close to the ground. *Axiocerces harpax*, one on the flowers of a yellow Composite.

September 22, 1905.—Tsessebe Station (Tati District), 94 miles

S. of Bulawayo, alt. 3900 ft. The Ant, *Camponotus fulvopilosus*, running on the ground.

SHOSHONG ROAD STATION, near the tropic, alt. 3250 ft. A number of the Ant, *Camponotus maculatus*, under the bark of a log.

ARTESIA STATION, BECHUANALAND, lat. *circa* 24° S., alt. 3100 ft. *Teracolus antigone*, a male. *Zeritis simplex*, Trim., a male. *Spindasis ella*, Hew. *Castalius calice*. *Syrichthus* (*Pyrgus*) *sataspes*, Trim. *Gomalia albofasciata*, a dwarf. The two Skippers were taken at water, as well as the Wasp *Eumenes lepeletieri*, ♀, and the Honey-bee *Apis mellifica*, of the usual S. African form.

MOCHUDI STATION, BECHUANALAND, lat. 24° 22′ S., alt. 3100 ft. *Acraea anemosa*, a female, drinking at the drip of a tap. *Zeritis molomo*, Trim., a female. *Hesperia spio*, Linn. (*vindex*, Cram.), at the flowers of a small yellow *Hibiscus*.

CROCODILE POOLS STATION, about lat. 24° 40′ S., alt. 3300 ft. A Beetle, *Zophosis* sp., not in the British Museum Collection, was taken running rapidly over the sand, which when alive it exactly matched in colour.[1]

OOTSI STATION, lat. 25° S., alt. 3620 ft. *Axiocerces harpax*, a female taken, and another seen at a shrub with flowers forming yellow tails. A Bug and a small Lady-bird, *Scymnus* sp., taken at *Combretum* flowers.

PITSANI STATION, lat. 25° 26′ S., alt. 4420 ft. *Semiothisa brongusaria*, a Boarmiid, came to light in the train. The two Beetles, *Lyctus* sp. and *Bostrychus brunneus*, Murray, were taken this day somewhere in British Bechuanaland, but the exact locality was not recorded.

Along the line at frequent intervals we passed the remains of the celebrated block-houses, sometimes elaborately fortified, sometimes decorated with stones, after the manner of small railway stations at home. Of course the Kaffirs had carried off everything of conceivable or inconceivable value, and often nothing was left but a heap of stones and a few old meat-tins. This day we had the pleasure of travelling in the same compartment with Professor A. Penck, of Berlin, and very good company he was. As we passed one of these accumulations of stones and tins, an English geologist called out, "See, Penck, is that a kitchen-midden?" He promptly replied, "No, that is a Kitchener-midden." It would have been a clever jest for an Englishman.

MAFEKING, lat. 25° 56′ S., alt. 4190 ft. Single specimens of *Sterrha*

[1] Many black beetles cover themselves with fine particles of the sand on which they dwell, and so easily escape observation.—See above, p. 163.

sacraria, Linn., and *Crambus tenuistriga*, Hmpsn., and two other moths were taken at lamps in the town. The S. African specimens of the *Sterrha* are far less beautiful than European, as they lack the crimson.

September 23, 1905.—WARRENTON STATION, 28° 11′ S., alt. 3930 ft. *Hesperia spio*, one at water.

POKWANI, 28° 43′ S., alt. 3650 ft. The ubiquitous *Utetheisa pulchella*.

September 24, 1905.—SHANKS STATION (E. of Steynsburg Junction), alt. *circa* 5000 ft. A Cricket was found under a stone, and in like situations six beetles, *Trigonopus* sp., not in the National Collection; the Carabids, *Harpalus xanthographus*, Wied., and *H. subaëneus*, Dej.; and the Chrysomelid, *Polysticta 24-signata*, Thunb., three specimens; as well as a number of the pungent Ant, *Acantholepis vestita*.

HANNINGTON STATION, alt. 5170 ft. The same *Trigonopus*, another *Polysticta 24-signata*, and *Harpalus fusco-aeneus*, Dej., were found under stones.

CONTAL STATION, a few miles east of Hannington, alt. *circa* 5200 ft. Under an old sleeper, three beetles were taken: the same *Trigonopus* that had been met with earlier in the day, *Harpalus rufo-cinctus*, Chaud. (*rufo-marginatus*, Boh.), and a Carabid near to *Percus*, not in the British Museum.

STORMBERG JUNCTION, lat. 31° 28′ S., alt. 5300 ft. A few hundred yards from the station we saw swarms of a purplish-grey migratory Locust with yellowish-drab wings and yellow hind tibiae, *Acridium pardalinum*. We had seen several flights shortly before reaching the station, but now we got amongst them. They did not fly very far, and the swarms were many rather than excessively large. The wings of those captured were much frayed, presumably by long flight and knocking against obstacles, though it is possible that individuals with damaged wings were more easily caught than sounder specimens.

Turning over stones was fairly productive, as it yielded *Harpalus rufo-cinctus*, seven; *H. natalensis*, Boh., four; *H. clavipes*, Boh., two; *H. subaëneus*, two; *H. fusco-aëneus*, three; two other Carabids not yet named; the red and black *Hister cruentus*, Erichs., four under one stone; *Polyhirma gracilis*, Dej., one; the two Weevils, *Rhytirrhinus lituratus*, Fåhr., and *Stramia* (?) *fåhraei*, Fst., one each, as well as an immature female of (?) *Blatta orientalis*, and two very large Ants, *Acantholepis vestita*. A specimen of *Pyrameis cardui* was taken on the hillside, but the day was scarcely fitted for butterflies.

LOWER INCLINE STATION, *circa* 4500 ft. Five or six specimens of *Polysticta 24-signata* were found close together under a stone.

QUEENSTOWN, Cape Colony, lat. 31° 50′ S., alt. 3500 ft. In the Public Gardens just before dark a large (?) *Plusia*, or small (?) *Sphinx* was seen at Verbena flowers, but missed. Shortly after leaving the station two of the widely distributed Crambid, *Eromene ocellea*, Haw., flew to the lights of the train.

EAST LONDON, lat. 33° S. Sea-level.

SECOND VISIT. September 25th—29th.

Six weeks had elapsed since our first flying visit to this place. After an unusual drought it had rained the day before our arrival, and it was blowing a violent gale when early in the morning we came to the end of our long railway journey of six days and six nights. The gale terminated with heavy rain that greatly damaged the condition of the butterflies. One victim of the flood, a female Saturniid, *Arina forda*, Westw., was rescued from drowning.

A good deal of our time was spent on our old ground in the Queen's Park. The Poinsettia flowers were over: energetic sanitary reformers had nearly completed the covering in of the unsavoury stream, but the operations of the Kaffir workmen had wrought sad havoc in some of the best collecting ground.

Mylothris agathina did not appear to be nearly so common as before, but perhaps this was owing to the absence of Poinsettia flowers to assemble them. There was, however, no doubt that the closely allied *M. rüppellii* was common enough. The males of both these species have a strong and seemingly identical sweetbriar-like scent. The very local and singularly elegant *M. trimenia* was quite common, both sexes being well represented. Its fore-wings are white, its hind-wings a beautiful yellow. I compared its scent to that of clover.

Belenois severina and *B. zochalia* were both very common; of the latter the females seemed to be more numerous than the males, but perhaps this was because they are more distinctly coloured.

The beautiful *Eronia cleodora* was quite common. A few *Pinacopteryx charina* were taken, all "dry"; a male *Byblia goetzius*, significantly a very fresh specimen, was distinctly of the "wet" form, but, with this possible exception, there was no evidence that the recent rains had produced any change of type, probably there had not been sufficient time. The only *Teracoli* noticed in the Park were

a male *achine* and several *omphale* of both sexes. These *Teracoli*, with one exception that was intermediate, were decidedly "dry," but not so extremely "dry" as our Rhodesian specimens.[1] *Colias electra* was seen but not taken.

Of *Papilio nireus*, f. *lyaeus*, we secured two males, but we met with both sexes of *P. demodocus*. Of *P. dardanus*, perhaps the commonest of the three Papilios, two males and one female were taken, the latter of the form *cenea*, which mimics *Amauris echeria*. Of the last-named species four specimens were taken, also three of the closely allied *A. albimaculata*; the latter at any rate has a strong disagreeable odour like musty straw; both forms are very hard to kill. *Danaida chrysippus* was fairly common.

Lycaenids were not so numerous as might have been expected in the Park, either as regards species or individuals. Of *Zizera lysimon* and *Cacyreus palemon* single specimens were taken; females of *Argiolaus silas* were fairly common, they flew high and settled on the tops of trees, but also visited flowers. A few of the widely ranging *Tarucus telicanus* were to be seen, two of them whilst at rest were observed to move the hind-wings alternately backwards and forwards in their own plane.

On the occasion of our former visit we saw no Satyrids, but this time two specimens of *Pseudonympha cassius* turned up, as well as two females and a male of *Mycalesis safitza*.

With the exception of *Charaxes varanes*, which was fairly common, though worn, the Nymphalines were not very prominent. *Eurytela hiarbas* was less plentiful and in less good condition than on our first visit; of *Byblia goetzius* only a single male was seen, while a *Precis archesia* was taken settled on the ground. Several fine *Pyrameis cardui* were observed.

Among the flowers introduced into the garden portion of the Park, and tending to run wild, was the Pride of Madeira, *Echium fastuosum*, a remarkable plant of the Natural Order *Boraginaceae*, whose small flowers form solid spikes, often 6 feet high or more, the apparently simple spikes being made up of innumerable, densely packed, scorpioidal cymes. The flowers, which have prominent stamens, may be blue, or creamy white, those in the Queen's Park being all of the latter variety. This plant proved very attractive to insects of several orders; among the numerous butterflies that fed upon the flowers was a single example of the pretty Vanessid, *Hypanartia hippomene*, Hübn. The following insects were also taken on the spikes:—*Apis adansoni*, as was only to be expected; the very

[1] See Dixey, *Proc. Ent. Soc. Lond.*, 1905, pp. lxi., lxvi.

small Bee *Prosopis sandaracata*, Bingh., with black and yellow thorax and red abdomen, was abundant, as was also the prettily marked *P. 5-lineata*, Cameron; but of *Prosopis simplex*, Bingh., *sp. nov.*, unfortunately only a unique example was secured;[1] there was also a Sawfly, *Athalia himantopus*, a female.

In addition there were on the same flowers a Fly of the genus *Catabomba*, three of the genus *Idia*, and another fly; the latter was found to be held in the clutches of a green Spider with red-brown markings, which, owing to its coloration, was practicably invisible among the crowded flowers, and would never have been detected but for its prey. But this does not exhaust the list, which includes the small Longicorn *Syessita vestigialis*, Pascoe, and a number of small Cetoniids. The most abundant of these was the little *Oxythyrea marginalis;* I noticed at the time that this beetle was rendered strangely inconspicuous by the creamy white specks on thorax and elytra breaking up the dark ground-colour and simulating the general look of the anthers of the flower. Another small Cetoniid, *Stringophorus flavipennis*, Gory & P., occurred on the same flowers and its elytra bear similar spots. Together with these were two specimens of a third and still smaller Cetoniid, *Comythovalgus fasciculatus*, Schönh., which were quite difficult to distinguish, but in this species the means of concealment are different, for the thorax and elytra bear numerous conical, horny projections, while there are two conical tufts of scales near the apex of the abdomen.[2]

Two specimens of *Gegenes letterstedti* were the only Hesperids noted; this species settles with the fore-wings raised, the hind-wings nearly horizontal, like several of our English Skippers.

The following Moths were taken, but doubtless the list might easily have been lengthened, especially if we had worked at night; *Macroglossa trochilus*, at flowers in the late afternoon; *Syntomis kuhlweini*, Lefebre; the day-flying Lymantriids *Laelia punctulata*, Butl., and *Aroa discalis*, Walk., males of the latter species being very common on the outskirts of the Park; the Geometers *Zerenopsis leopardina*, Feld., fluttering near the ground; *Craspedia internata*, Guen. (*striguliferа*, Walk.), and the variable *Semiothisa brongusaria*; we also kicked up a Pyrale, *Pyrausta incoloralis*, Guen., and two specimens of the Boarmiid *Obolcola inconclusaria*, Walk., one of each sex.

As usual the most obvious representatives of the Hymenoptera were the handsome Carpenter-bees, *Xylocopa caffra*, ♀; *X. fraterna*,

[1] See footnote, p. 182, *supra*.

[2] See Longstaff, *Trans. Ent. Soc. Lond.*, 1906, pp. 91–93.

Vachal, a male said by Colonel Bingham to be not typical; *X. divisa*, ♀; and *X. flavo-rufa*, De Geer, four females; the last two species were practically confined to the purple flowers of a Leguminous shrub; *flavo-rufa* has a strong odour like that of our English Bumble-bees. Other Aculeates taken were the long-pedunculated Wasps *Belonogaster praunsi* (said by Colonel C. T. Bingham to be not typical); the slender dark-blue-winged *Eumenes tinctor*, of both sexes, one male specimen, of Saussure's variety, very starved examples; the dull grey *Icaria cincta*, ☿; *Pompilus ruficeps*, Smith, a female; a male *Pompilus* which is possibly new; *Polistes marginalis*, Fabr., ☿; *Larra agilis*, Smith, a female, taken on a bank of dry earth; a Mason-bee, *Chalicodoma coelocera*, male, taken at the purple flowers along with the *Xylocopae*. To these must be added Ants from a community of *Camponotus maculatus*, and a fine specimen of the common coral-red Braconid *Iphiaulax whitei*.

The handsome *Eristalis taeniops* was conspicuous among the Flies, which were not very numerously represented; another fly to which Colonel Yerbury has been able to assign a name is *Chaetolyga dasyops*, Wied. Other flies were (?) *Syrphus* sp., *Idia* sp., and two *Bibio*-like *Plecia* sp., which floated in the air almost stationary with their long legs hanging down; sweeping yielded a *Diopsis*, a solitary example which Mr. Verrall thought distinct from the others that we brought home.

The wide-ranging Grasshopper *Catantops melanostictus* was abundant. On the leaves of Pride of Madeira were marshalled a number of immature specimens of a gregarious dark orange-striped Acridian, the same species that was seen at Bulawayo.

Although Beetles were not numerous in the Park, we took, in addition to the Cetoniids previously mentioned, some interesting species: *Macroma cognata*, a handsome dark olive and yellow Cetoniid, flying at flowers; *Gametis balteata*, De Geer, another of the same group, also a conspicuous species though much smaller than the last. This beetle is black and red, or perhaps orange-brown more correctly describes its decoration. On the Second Creek of the Buffalo River, there grows a profusion of a climbing Composite with greenish-white flowers (? *Senecio* sp.), a plant nevertheless in general habit and appearance very suggestive of *Clematis vitalba*, Linn. On one of these plants I took a number of specimens of two species of *Haplolycus*, which are represented in the National Collection but as yet unnamed. These Malacoderms have the usual *Lycus* coloration, viz. orange-brown with the apical two-fifths of the elytra black, and a black stripe down the middle of the thorax. On the same day, on

another bush of the same climbing Composite growing a hundred yards higher up the stream, I took an example of *Gametis balteata*, and was at once struck by the striking resemblance of the two insects. I may remind any entomologists who may not be familiar with living specimens of beetles of the *Lycus* group, that during life the orange-brown colour is much redder than might be supposed from cabinet specimens, whereas the Cetoniid preserves its colour well. The very next day Dr. Dixey saw both these beetles in some numbers (3 *Haplolycus* and 8 *Gametis*) in the Queen's Park on and about a flowering tree and noted their similarity. With them were two specimens of a Lycoid-coloured Braconid (*Zombrus* sp.). The *Gametis* resembles the *Haplolycus* the other way on, the head of the one being coloured like the tail of the other, but probably that fact does not detract from any benefit that it may derive from the likeness. Mr. G. A. K. Marshall has proved experimentally that Lycid beetles are very distasteful to Kestrels and Baboons. *Gametis balteata* may now be added to the wonderful synaposematic Lycoid group figured in Mr. Marshall's valuable paper.[1]

Other beetles taken in the Park were the Longicorns, *Promeces iris*, Pascoe, and *Alphitopola maculosa*, Pascoe, var., by beating; *Trigonopus marginatus*, Wied., several under stones; also under a stone the Staphylinid *Xantholinus hottentotus*, Sachse; a Phytophagid not in the National Collection, *Atechna inenaerabilis*, Vogel, var.; *Apoderus nigripennis*, Fabr.; the metallic green *Colasposoma flavipes*, Har.; the Cassid *Aspidomorpha silacea*, Boh. (*tecta*, var., Boh.); and a Weevil, *Balaninus apicalis*, Fåhr., var. B., which was obtained by beating.

Two Bugs complete the list of insects taken in the Queen's Park: a black Pentatomid with red-tipped antennae, *Aspongopus lividus*, Dist., and a large Coreid, *Carlisis wahlbergi*, Stål, dark brown with red-ringed antennae, a very striking thing on the wing, very stinking in the net.

I may remark that throughout South Africa large Millipedes (*Julus*) are very common. Many of these are of a foxy-brown colour; a black one with red-brown legs found under a stone in the Queen's Park measured 5½ inches in length.

On September 27th, by the kindness of Mr. John Wood, who was accompanied by Mr. Rattray, we spent a very pleasant afternoon on the Nahoon River, a few miles to the north-east of the town.

[1] *Trans. Ent. Soc. Lond.*, 1902, pp. 340, 344, 380, 515–518, and Plate XVIII. "A synaposematic group" is a group exhibiting the same "warning colours."—Müllerian Mimicry.

We were somewhat late in the day and a strong wind was another adverse condition, so that we got very few butterflies.

On the island where we lunched, *Belenois severina* was abundant and *Mylothris rüppellii*, the only representative of the genus, was common; *Pinacopteryx charina*, *Eronia cleodora*, and *Atella phalantha* also occurred. A Geometer, *Ectropis spoliataria*, Walk., a small Noctua, *Ozarba* (*Erastria*) *corniculans*, Wallgr., and a very handsome Agaristid, *Xanthospilopteryx africana*, Butl., taken off a tree-trunk, completed the Lepidoptera on the island. Sunning itself on another tree-trunk close by was a brilliant green Hymenopteron, *Ampulex mutilloides*, Kohl, ♀. Mr. Rattray caught a specimen of the scarlet Braconid, *Iphiaulax whitei*, which appears to be very common in South Africa.

Mr. Wood set a stalwart Kaffir to work with an axe to hack dead trees to pieces. This did not prove a very productive operation; moreover of the creatures found but a small proportion have yet been named. Among the beetles were single specimens of the Longicorn, *Promecidus chalybeatus*, White; the Sternoxid *Alaus moerens*, Germ., and a species of *Notiophygus*. *Blattae* were numerous, Mr. Shelford has named for us *Hyposphaeria stylifera*, Burm., immature; *Bantua* (?) *brunneriana*, Costa, several; also *Pseudo-deropeltis albilatera*, Stål, two specimens, and *P. wahlbergi*, Stål, a male. Bugs were represented by a singularly flat form, well adapted to its life under bark. It goes without saying that Woodlice were plentiful.

Taking a boat the Kaffir pulled us a mile or two down the river and we landed on the eastern bank, where rich flowery meadows promised great things, but the rising of the wind and the lateness of the hour led to disappointment. A single *Teracolus achine*, ♂, a Boarmiid moth, *Osteodes turbulenta*, and a Pyrale, *Antigastra morysalis* were the only Lepidoptera that we brought away from a spot which under more favourable conditions should swarm with them. Beetles are somewhat less susceptible, and we took on flowers the gem-like Cetoniid *Oxythyrea haemorrhoidalis*, Fabr. (which surely deserves a better name) together with the commoner *O. marginalis*, also the Longicorn *Hylomela sexpunctata*, which closely mimics a species of *Mylabris* (or ? *Ceroctis*) that we met with in South Rhodesia. The Acridian *Cyrtacanthacaris ruficornis*, Fabr., of which two were taken, is remarkably coloured: brown, with a paler stripe down the back, the blue tibiae are furnished with conspicuous white spines tipped with reddish.

Sweeping added to the list the Lady-birds *Atechna hebe*, Clk., and *Cryptocephalus flavago*, Suff., the Weevil *Ellimenistes squamifer*,

Boh.; also the Phytophaga, *Ootheca laevipennis*, Jac., *Gynandrophthalma malvernensis*, Jac., var., and *Luperus inconspicuus*, Jac., as well as a rather pretty Bug *Veterna sanguineirostris*, Thunb., the common Grasshopper *Catantops melanostictus*, and the Tettigid *Prototettix impressus*.

We took two pedunculated Wasps, *Belonogaster praunsi*, and *Ammophila ferrugineipes*, a male; also an Ichneumon-fly, and a number of Ants, *Cremastogaster sordidula*, var., and *Pheidole irritans*, of which last the soldiers alone have big red heads.

Turning over stones yielded the Beetles *Trigonopus marginatus*, and *Lissogenius conspersus*, Burm., as well as the common South African Reduviid *Physorrhynchus crux*, and two Scorpions.

A specimen of the Scarab *Syrichthus spurius*, Burm., was picked off the ground, while Mr. Rattray found a specimen of the large thick-legged Coreid bug *Rhyticoris terminalis*, Burm., also a large Weevil with very hard integuments, *Mecorrhynchus loripes*, Schönh., and two Millipedes whose integuments turned the point of No. 16 pins. Mr. Wood found lying dead on the left bank of the Nahoon a Carabid beetle, *Haplotrachelus* sp., which is not in the National Collection.

The Kaffir boatman caught several of a *Psammodes* unrepresented at South Kensington, they were crawling over the rocks by the lower landing-place, nearly opposite the Boat Club House.

A few Snails were picked up, viz. a young specimen of *Pachnodus natalensis*, Krauss; a variety of the *Helix*-like *Tropidophora insularis*, Pfr., and a number of the very long, finely sculptured spires of *Coeliaxis layardi*, Ad. & Aug.

Lastly, on the west bank when it was quite evening a Hesperid was netted, *Sarangesa motozi*.

An old termitarium on the high ground above the Club House yielded, besides sundry ants (*Cremastogaster weitzeckeri*, Emery), a Night Adder, a small serpent said to be very poisonous.

Since our return to England, we have been much concerned at hearing of a disastrous flood at East London, which seems to have devastated the island in the River Nahoon where some of our collecting was done, and to have caused the death by drowning of several natives, including our Kaffir boatman and his family. Much damage has been done on the banks of the Nahoon and Buffalo rivers, and part even of the Queen's Park is reported to have been washed away.

Acting on the advice of Messrs. Wood and Rattray, we spent the next day, September 28th, on the SECOND CREEK of the Buffalo

River, a delightful locality. It is approached by a pleasant walk over open downs where we met our old friends *Synchloë hellica*, *Colias electra*, and *Teracolus omphale;* after a mile or so the path enters a wood, and descends rapidly to a brawling stream, which follows an impetuous course to a fall into a tidal pool, beyond which is a flowery meadow forming the delta of the creek. The wider tracks through the upper part of the wood had a home-like feeling, and we almost expected to see Pearl-bordered Fritillaries disporting themselves about the flowers, but instead of these we found in moist places the pretty Satyrid, *Pseudonympha cassius.* These butterflies were of less "dry" form than most that we had met with, the majority of them might be better described as intermediate. The more generally distributed and homely *Mycalesis safitza* was also common; a female exhibited a supplementary ocellus on the fore-wing.

The commonest White was *Pinacopteryx charina*, but *Eronia cleodora*, *Belenois zochalia* and *Mylothris agathina* were all present in some numbers, and one *M. trimenia* was taken. *Teracolus omphale* and *T. achine* occurred in the more open places.

The *Acraeinae* were conspicuous by their absence, but the *Danainae* were represented by *Amauris echeria* and *albimaculata*, as well as by *Danaida chrysippus.*

The only Nymphalines taken were *Byblia goetzius*, *Atella phalantha*, and a solitary *Precis archesia*, a species which according to Mr. Brooking of East London frequents dark holes in rocks.

Lycaenids were not common, a solitary *Tarucus telicanus*, and a couple each of *Axiocerces harpax* and *Phasis chrysaor*, Trim., one settled head downwards, were taken.

We took four Hesperids, viz. one each of *Hesperia spio*, *Eretis djaelaelae*, *Gegenes letterstedti*, and *Pterygospidea flesus.* The last-named after dashing about wildly settled on the *upper* side of a leaf.

But few moths were seen, and two specimens of *Osteodes turbulenta*, and the Syntomid mentioned below were all that we caught.

The greenish-white flowers of a climbing Composite (? *Senecio* sp.) that spread in dense mats over some of the bushes by the stream were very attractive to insects of more than one order. Two Aculeates, *Xylocopa divisa*, ♀, and *Eumenes tinctor*, ♀, two, one of them a starved dwarf; the moth *Syntomis kuhlweini* (one found to be in the tender embraces of a spider); the Fly *Eristalis taeniops*, the Reduviid bug *Harpactor erythrocnemis*, Germ.; two Lycoid beetles, *Acantholycus* sp. and *Haplolycus* sp. (the latter numerous), and their mimic the Cetoniid *Gametis balteata* (referred to above) were all

taken off this plant, together with a Mantis that was presumably attracted by the insects rather than the flowers.

Dr. Dixey found on a tree another small Mantis, bright leaf-green in colour, which he kept alive for over a week. It was seen to catch a fly by a motion of lightning-like quickness and eat it, rejecting the wings and abdomen. When approached it would smartly assume the "praying" attitude, sometimes also turning its head in the direction of the visitor. It used to clean its eyes by passing its fore-legs over them, with an action like that of a cat cleaning its face. It also cleaned its antennae in its mouth, bringing them down by its fore-legs.

A soft-skinned Cantharid, *Decatoma lunata*, Pallas, looked conspicuous enough on a pale straw-yellow liliaceous flower.

It was at the Second Creek that the finding of two species of *Heterochelus*, allied to *vulpinus*, Burm., buried in yellow Composite flowers, first drew my attention to the little Lamellicorn beetles of the sub-family *Hopliinae*. They are numerous in Cape Colony, and we came across no less than thirteen species. The most obvious characteristic of the group is the great length of their posterior legs. The development of these varies greatly in different species, but as a general rule is much greater in the males than in the females; indeed in some species the male femora and tibiae are grotesquely disproportioned to the animals; moreover both femora and tibiae are provided on their inner sides with strong spurs or spines (perhaps better described as teeth). These strange limbs evidently attracted the attention of the older writers, since Fabricius named one species *dentipes*, and Burmeister another *forcipatus*. The explanation of these hypertrophied legs that is usually received is that they are used by the males to grasp the females. Mr. Trimen, accepting this explanation, tells me that he thinks copulation is attended with especial difficulty in these beetles.

The latest writer on the subject, Mr. Péringuey, rejects the ordinary explanation in the following words:—

"The great development of the hind-legs is not intended for securing a better hold of the female. There is nothing more ridiculous than to see half a dozen males with their long hind-legs emerging from the pistils of a Composite flower where they are mobbing a female which is almost entirely buried head foremost in the pistils, the sub-horizontal pygidium alone being exposed to view. But it is when disentangling themselves that the use of the long hind-legs becomes apparent; by means of his long, hinged claw the male hooks himself out of the corolla. It is not only amongst the flower-

frequenting kinds that this extraordinary development of the hind-legs with their curiously serrate, dentate and mucronate tibiae is met with, because the species of *Hoplocnemis*, in which the development has become almost a monstrosity, do not feed on flowers, or at least have not been observed doing so. The habits seem to be more those of certain *Dynastinae*, and I suspect them to live, while in the larval state, in the excrement deposits of the subterranean white ant, *Hodotermes viator*, Latr."[1]

Mr. Péringuey, I am bound to say, fails to convince me, and I venture upon yet another explanation.

Many of the species of *Dichelus* and *Heterochelus* burrow into the disks of Composite flowers, eating out the ovaries. When so engaged

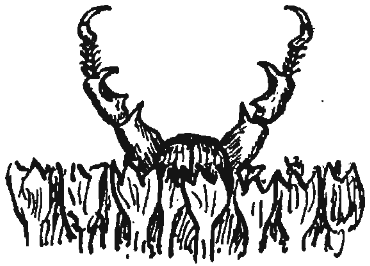


FIG. 8.—Diagram of posterior legs of *Heterochelus*, ♂ (×5 diam.).
The body of the beetle is buried in the florets of a Composite flower.

the whole of the body of the insect may disappear from view, or the extremity of the abdomen may alone protrude, but in either case the hind-legs extend beyond the florets, widely separated and closely resembling the open jaws of an ant-lion. While picking one out of a flower I was startled by receiving a very respectable pinch, or bite, inflicted by the formidable teeth mentioned above.

Now the suggestion that I have to offer is this: while probably in the first instance adapted to assist the male insect in grasping its mate, these huge hind-legs are now of great advantage to the otherwise helpless beetle when burrowing into flowers in search of food. The widely gaping "jaws" may probably terrify some enemies, but they

[1] *Transactions of the South African Philosophical Society*, vol. xii., pp. 525, 626. "Descriptive Catalogue of the Coleoptera of South Africa: Hopliinae." 1902. By L. Péringuey, F.E.S.

certainly afford by no means despicable weapons of defence against such foes as may presume to come to close quarters.

This suggestion meets with support from the fact that *Lepitrix lineata*, Fabr., a pretty species that I found abundant on the flowers of *Mesembryanthemum* at Simon's Town, has long thin hind-legs not provided with teeth, but, unlike *Heterochelus* and *Dichelus*, this insect is very active, taking to its wings almost as readily as a bee. Dr. Dixey did not notice this beetle on *Mesembryanthemum*, but not far off found five specimens inside the spathes of the Cape Lily, or common white Arum, *Calla aethiopica* (*Richardia africana*), three in one spathe and two in another. He says that they did not attempt to fly. Possibly the fact that they were to some extent enclosed in the arum, whereas those on *Mesembryanthemum* were quite exposed, making no attempt to burrow like *Heterochelus*, may explain this notable difference of habit.

Mr. Trimen in the introductory chapter of his "South African Butterflies," after remarking on the poverty of the *Rhopalocera* of the Cape Peninsula as compared with the richness of its Flora, and stating that in that part of the world butterflies cannot perform a very prominent part in the fertilization of flowers, goes on to say: "The great number of densely-hairy flower-frequenting *Coleoptera* in South Africa must also play a large part in plant fertilization."[1] The beetles referred to are chiefly *Lamellicornia* of the sub-families *Cetoniinae* and *Hopliinae*.

The meadows by the estuary yielded a different lot of things, especially Phytophaga and Weevils. Thus *Malacosoma polita*, Jac., was abundant in the flowers of an Iris, while sweeping yielded *Ootheca laevipennis*, *Cryptocephalus polyhistor*, Suff., *Trochalus* sp., two, and the Cetoniid *Oxythyrea haemorrhoidalis*, as well as the following small Weevils:—*Eremnus gyrosicollis*, Boh., *Sciobius o'neili*, Mrshll., ♀, *S. pullus*, *Strophosomus* sp., and two new species which Mr. G. A. K. Marshall has described[2] under the names *Ellimenistes callosicollis*, *sp. nov.*, and *Myorrhinus longstaffi*, *sp. nov.* [see Plate II., Figs. 1, 3]. Both these insects are black: the first (of which I obtained four examples) covered with brownish grey scales, Mr. Marshall says, is somewhat intermediate between *E. pulvinaticollis*, Boh., and *E. bidentatus*, Boh.; the second, which was to be had in abundance, is a much smaller insect, covered with light-green scaling, and is said by Mr. Marshall to be nearly allied to *M. setarius*, Fåhr., but with much more obvious setae. With the beetles in the sweeping

[1] *Op. cit.*, vol. i., p. 42, note.

[2] Marshall, *Proc. Zool. Soc. Lond.*, 1906, pp. 922 and 932.

net were two Bugs, a black, yellow-spotted *Stenozygum* that is possibly new, and the large pale ochreous, fetid Pentatomid, *Basicryptus distinctus*, Sign.

Other beetles taken in the same locality were the Lady-birds *Chilomenes lunata*, and *Polysticta macularis*, Dej.; *Melyris ciliatus*, Oliv.; the Halticid, *Physodactyla africana*, Chap.; a *Trochalus* apparently undescribed; a *Telephorus*; a *Lagria;* and a Scarabaeid, *Syrichthus spurius*, Burm., the last found in rotten wood.

Among Orthoptera were the big *Phymateus leprosus*, the common *Catantops melanostictus*, *Prototettix impressus*, the handsome *Acridium ruficorne*, and two unnamed Grasshoppers, one grass-green, the other a curiously soft species, black with scarlet rings and spots.

The only Flies taken were two Bombyliids of the genus *Systoechus*, one at flowers, the other by sweeping.

A few Aculeates complete the list, viz.: *Xylocopa flavo-rufa*, a male; *X. divisa*, a female; the prettily variegated *Polistes fastidiosus*, a female; the grey *Icaria cincta*, a worker; two small black Bees, *Halictus deceptus*, Smith, females; lastly a fine distinct red, yellow and black wasp, which the late Colonel C. T. Bingham described as *Odynerus longstaffi*, *sp. nov.*, from a specimen in the National Collection from Natal, hitherto unnamed, making our specimen a co-type. [Plate II., Fig. 6; see footnote p. 182, *supra*.] Lastly an example of the blue-green Chrysid *Hexachrysis simillimus*, Grib., was taken settled on a bare rock, gleaming like a piece of copper-glance.

On our return walk we kicked up a Noctua in the wood, and as we reached its upper edge at about 3 p.m., we found Termites on the wing in swarms; five specimens were brought home alive in separate pill-boxes, but on reaching the hotel it was found that one had cast off a wing, another all four wings. Later in the afternoon *Syntomis kuhlweini* was found in some numbers flying about, or settled upon a particular species of tree. The large Reduviid bug *Physorrhynchus crux* was also taken on the wing.

On the morning of sailing, September 29th, I paid a somewhat hurried visit to the scrub-crowned sandhills seen from the ship that August morning when we first anchored at East London, but this expedition did not add much to our list.

Two Ants turned up, *Camponotus cosmicus*, also taken at Estcourt, and *Polyrhachis gagates*, Smith, of which but a single specimen was met with in this land of ants; there were also the following Aculeates: *Polistes marginalis*, worker, *Belonogaster guerini*, var. *dubius*, worker (a very large specimen), *Eumenes tinctor*, female, *Icaria cincta*, worker, the big Carpenter-bee *Xylocopa flavo-rufa*, male, and

two of the pretty little Bees *Prosopis 5-lineata,* taken at a red flowering shrub. The only other Hymenopteron was an Ichneumon-fly with Lycoid colouring.

A Fly that seemed to mimic a pedunculated Wasp Colonel Yerbury says may be the male of *Baccha picta,* Wied., of which that author described the female only from the Congo and Guinea. Another fly taken would appear to be *Sarcophaga carnaria.*

Beetles proved less numerous than might have been expected: two Tiger-beetles, the first we had seen in South Africa, *Cicindela candida,* Dej., and *C. capensis,* Fabr., were common close to the sea on the bare sand, which they so closely resembled in colour as to be scarcely visible save when on the wing. Also running on the sand was a nameless *Zophosis* and an equally nameless *Anoplochilus.* The flowers of a species of Iris produced *Camptolenes fastuosa,* Lac., besides abundance of *Malacosoma polita.*

Lissogenius conspersus was taken flying in the sun, as was also *Scarabaeus convexus,* Hausm., and the Cassid *Aspidomorpha tecta,* Boh., the latter looking like a golden spangle floating in a sunbeam. The Hopliine *Khoina bilateralis,* Thunb., was found on flowers, and *Eurynotus muricatus,* Kirby, under bark.

The Coreid *Serinetha amista,* Germ., seems to mimic a *Lycus.* Another bug taken was the Reduviid *Harpactor segmentarius,* Germ.

Orthoptera were rather common, conspicuous among them was a very fine specimen of the large, heavy and sluggish *Phymateus* (?) *leprosus,* more glaucous than those taken at Ladysmith, so that they match more closely the light-coloured sand. Mr. Kirby thinks that it may possibly be a new species [Plate II., Fig. 7]. The beautiful apple-green *Tryxalis ståli,* darker above, paler beneath as is so often the case, was found at the verge of vegetation, while an abundant Grasshopper found on the bare sand was highly cryptic. A curiously formed small Hemerobiid Neuropteron, *Mantispa* (?) *tenella,* Erichs., was taken on the wing; seen for the first time its resemblance to a Mantis was startling.

Perhaps the locality was too much exposed for butterflies, at all events they were neither numerous nor remarkable:—*Amauris albimaculata,* a female; *Eurytela hiarbas,* within 100 yards of the sea; *Byblia goetzius,* a female, "dry"; *Pseudonympha cassius; Argiolaus silas,* a female; *Mylothris rüppellii,* a female; *Pinacopteryx charina; Colias electra; Teracolus omphale,* a female, and the Skipper *Eretis djaelaelae.* A Geometer, *Obolcola inconclusaria,* a male, and the Lymantriid *Aroa discalis,* which was common flying about the scrub, were the only moths.

The lights at the hotel yielded only *Dorylus helvolus*, all males, the very widely distributed Acidaliid *Idaea fibulata*, and one or two other moths not yet named.

The cosmopolitan *Dermestes vulpinus* shared the hotel accommodation with us, while *Cimex lectularius*, Linn., was even more intimate.

Thus ended our delightful collecting at East London, a place less known entomologically than many others in South Africa.

PORT ELIZABETH, CAPE COLONY, lat. 34° S.

SECOND VISIT. September 30th, 1905.

The stoppage on the return voyage gave us a long morning's collecting; but an accident separated us, so that while I visited HUMEWOOD, about a mile and a half to the south-east, Dr. Dixey spent his time, more profitably as it turned out, on the more sheltered slopes of the left bank of Baaken's River, just north of Fort Frederick. At this spot butterflies were plentiful. The males of *Colias electra* were common, as were both sexes of *Synchloë hellica*, while *Pyrameis cardui* was in abundance, some worn, but many in fine condition. The Skipper *Cyclopides metis*, Linn., was fairly common, but only two were taken, together with one *Gegenes letterstedti*, a female; but out of many Lycaenids seen flying about only a single specimen of *Zizera lysimon* was secured. This Blue was found by us over a wide range of country, but nowhere in any numbers except in the Rain Forest at Victoria Falls.

A yellowish-brown Grasshopper, *Epacromia thalassina*, Fabr., with head, thorax and jumping legs green, was also taken.

On the north wall of the Fort itself, or on the ground close by, considerable numbers of the red and brown Bug *Scantius forsteri*, Fabr., were found, for the most part paired. Many of them exuded a drop of clear liquid when pinned, and in one or two a slight, somewhat offensive odour was detected.

The swampy heath-like waste beyond Humewood and the woods at the back of it proved very barren of insect life, partly perhaps from the uniformity of the vegetation, partly from exposure to the sea-winds. A few *Synchloë hellica* of both sexes and three or four *Pyrameis cardui* were the only butterflies seen.

Stone-turning yielded a small Beetle which Mr. L. Péringuey believes to be a new species of *Anaulacus*, but possibly a *Microus*; four *Eurynolus muricatus*, also another species of the same genus

that may be new; one larva of *Luciola* sp.; the Cockroach *Deropeltis erythrocephala*, as is so common with the group, was very local and markedly gregarious.

Two Snakes found under a log warned me to be discreet in prying into secluded dwelling-places. I was fairly accustomed to Scorpions.

Five specimens of an undetermined beetle were found on Composite flowers. Sweeping produced a red-winged Homopteron. Two Dragon-flies, *Sympetrum sanguineum*, Müll., a common species, and the large and beautifully coloured *Anax mauricanus*, Ramb., were neither of them easy to catch. A common-looking Greenbottle, *Lucilia* sp., was taken, but the species, or others like it, was abundant throughout our journey.

The flowers of a yellow Chrysanthemum in the garden of the Humewood Hotel attracted a certain number of insects: *Apis adansoni*; the active green Longicorn *Promeces linearis*; and the Hopliine *Dicranocnemus squamosus*, Burm., the last-named in abundance buried in the flowers (and in other *Compositae*); but it was noted that their hind-legs did *not* mimic jaws.

Cape Town, lat. 34° S.

SECOND VISIT. October 2nd and 3rd.

The first day was devoted by the author to the ascent of Table Mountain by way of The Gorge.

Most of the collecting was along the road at about 1200 ft. above the sea. Butterflies were scarce; a few specimens of *Pyrameis cardui*, *Pseudonympha vigilans*, Trim., and the Lycaenid *Cacyreus palemon*, were all that I saw.

The fine black and white Carabid, *Anthia 10-guttata*, Fabr., was not uncommon running on the path; when handled it emitted a very pungent odour; one specimen of this beetle was taken in a pine wood just above the outskirts of the town. It was noted that this beetle was not so swift in its movements as the Biskra species *A. sex-maculata*, Fabr.; probably the struggle for existence is not so severe on the Cape Peninsula as on the Sahara. Under stones five specimens of *Microlestia tabida* were taken. But the greatest numbers of beetles were found on, or actually *in* Composite flowers, especially those of a species of *Senecio*. The most abundant species was the Hopliine *Heterochelus forcipatus*, a species in which the posterior legs are enormously developed in the male sex; no females were seen. With these were a few (3 ♂, 1 ♀) of the allied *Dichelus dentipes*, of which also the males have large posterior legs. There were also a

number of *Encyophanes* sp. (unnamed in Brit. Mus.) of both sexes. All these were buried in the disks of the flower with only the hind-legs protruding.[1] A specimen of the hairy Hopliine *Anisonyx lynx*, Fabr., was taken in another Composite flower, *Gazania* sp.

By shaking the flowers of a *Senecio* into the net the following were obtained: *Ootheca tricolor*, Fabr., two; (?) *Hedybius* sp., six; a very small Weevil, an Erirrhinid of uncertain genus, one; *Oosomus* sp., seven; several *Telephori*, and a Cricket.

At the flowers of a yellow leguminous shrub two workers of *Apis adansoni* were taken, together with three Bees of the genus *Megachile*, all males, all distinct species, and all apparently new! However, Colonel C. T. Bingham said that it was useless in that genus to describe males without females. It was noted with surprise that the beautiful strong-scented, golden-yellow blossoms of the *Protea*, an endemic shrub highly characteristic of the Cape Peninsula, attracted nothing but a few flies. At about 1400 ft. *Bombylius lateralis*, Fabr., was met with, and the Satyrid *Pseudonympha vigilans* up to 1500 ft.

The summit, 3600 ft., was in dense cloud, for the "table-cloth" was spread, and the only insects taken at that altitude were hairy Hopliines; two *Anisonyx lynx*, and one *A. ursus*, Fabr.; two were on flowers, one on the wing.

Turning over stones at the foot of the Lion Hill, *circa* 300 ft., yielded two Ants, *Acantholepis capensis*; the Beetle *Oncotus tardus*, Sol.; a larva of *Luciola* sp., and the Cockroach *Temnopteryx phalerata*, Sauss.

The next day we took train to SIMON'S TOWN, which lies about fifteen miles to the south of Cape Town. Here our collecting was confined to a strip of sandy ground with eastern aspect, close to the shore and at the foot of the line of hills, perhaps 3000 ft. in height, capped with sandstone crags, which overlook Simon's Bay.

As we came out of the station a large blue-black Carpenter-bee, *Xylocopa capensis*, Lepel., dashed at Dr. Dixey's head; forthwith I made violent efforts to catch the bee, and for some time the bewildered entomologist was in considerable peril between the swoops of the net and the assaults of the Aculeate.

The Heteromerous beetle, *Opatrum* (?) *arenarium*, was common in a very sandy place under stones, and in like situation were single specimens of *Harpalus fuscipennis*, Wied., and the black and red Reduviid bug *Acanthaspis lythrodes*, Germ., of which the British Museum possesses but a solitary example.

[1] See above, p. 248, F

The dry sandy soil, scorched by the sun and exposed to the sea winds, is thoroughly suited to the taste of a *Mesembryanthemum*, which grew luxuriantly, its handsome flowers attracting many insects. Among these was the Hopliine beetle, *Lepitrix lineata*, referred to above, which was abundant at one spot close to the railway station. Unlike the *Dicheli* and *Heterocheli*, they did not bury themselves among the stamens of the flowers, but were as active as bees. On the other hand, some small black Bees with white-ringed abdomen, *Halictus albofasciatus*, Smith, ♂, *did* bury themselves in the *Mesembryanthemum*, but nevertheless were so active as to be difficult to catch; associated with them, closely mimicking them, and almost equally hard to catch, were some Flies (?) *Ploas* sp. and (?) *Prorachthes* sp. The mimicry, especially in habits, was very marked during life, yet in the cabinet the insects look distinct enough.

On other flowers were such small things as six green beetles, (?) *Hedybius* sp., the tiny Eumolpid *Eurysthenes balyi*, Chap., a *Eutrapela* sp., which stands without a name at South Kensington; *Attagenus* sp.; *Harpalus xanthographus*, Wied.; *Telephorus* sp.; the Hopliine *Pachycnema obscurepurpuria*, De Geer, a ♀; also one of each sex of a small Bee, *Dasypoda* sp., which according to Colonel Bingham is near to, but distinct from *discincta*, Ill., and the little *Halictus terminalis*, Smith, ♀. A yellow Liliaceous flower was tenanted by a small beetle, *Notoxus inconstans*, Lafert.

The black and yellow *Ceroctis capensis*, Linn., was found in the yellow flower of a prickly Composite, while in the flowers of *Senecio* (?) *concolor* (a species with purple ray-florets) were numbers of a small Heteromeron, *Notoxus* sp.

Close to the beach, running swiftly over the sand and taking the short flights so characteristic of the genus, were several *Cicindela brevicollis*, Wied. An Asilid, (?) *Dysmachus* sp., was fond of settling on the bare sand. The Elater *Oedisternon cupreum*, Linn., was also taken on the sand; during life it was of an iridescent bronze colour, which proved very fugitive.

On a tuft of grass, above the ground, a semi-papyraceous nest was found to be tenanted by a numerous community of ants, *Cremastogaster stadelmanni*, Mayr.

Lastly, on the heathy scrub on the hillside at Glencairn two Lycaenids were taken, *Phasis thero*, Linn., and *Cacyreus thespis*, Linn. With them was a Fly, *Haematopota* sp.

Just before embarking we drove down to The Flats, near Claremont, but the weather conditions were unfavourable and the results wholly disappointing. *Pyrameis cardui* and *Pseudonympha cassius*

were the only butterflies obtained; the latter was worn, and appeared to be of the wet-season form. An as yet undetermined Moth (? *Pseudosterrha* sp.), a Grasshopper and a few very ordinary Flies, *Eristalis tenax*, *Catabomba* sp., and *Calliphora vomitoria*, Linn., were the only other things taken.

Thus ended our eight weeks in Africa, resulting in the capture of some 2500 specimens of all orders. So extensive is the fauna and so far from being exhausted, that even in this scamper (for our journey may well be so designated) several new species were taken, while there remain a number of insects not yet worked out which almost certainly include several other novelties.

During the voyage home, on the tenth day out from Cape Town, at about 10 a.m. on October 14th, I saw a small Pyrale on the hurricane deck; it looked like a species that I had seen in South Africa. It was in good condition, and appeared to be a feeble flier. Not having a box handy it was blown away before I could secure it. The "Walmer Castle" was at the time about 2° north of Cape Verde, and the land distant about fifty miles. The wind was westerly, squally with much rain. It is of course quite probable that the moth might have been disturbed from among the cargo or the ship's provisions.

At Madeira on October 17th, at 10.15 a.m., in bright sunshine I watched a Convolvulus Hawk at the blue flowers of *Plumbago*. When feeding there were at least 2 inches of proboscis between moth and flowers.

CHAPTER VI.

WEST INDIES AND SOUTH AMERICA, 1906–7.

BARBADOS, lat. 13° 5′ N.

December 18th, 1906.

THERE is nothing specially impressive or romantic about the appearance of BARBADOS itself as seen from the sea. But the way in which the lusty negro boatmen urged the coal-lighters against the Trade-wind was a sight to be seen, as they are fine specimens of humanity, and showed to advantage in bending to the great sweeps. The Barbadian negro is the best of his kind, and boating seems to bring out his best qualities. I had some years before seen something of the Bermuda boatmen, and to see was to admire. The negro will not put forth his strength without a spur, and such a spur is supplied by wind and waves.

Having breakfasted on flying-fish in the approved fashion, we resolved to devote the very short time at our disposal to visiting the Belle Estate. It was the end of the rainy season; a shower had fallen early that morning. We were told that there had been a great deal of rain in November; the Trade-wind was blowing strongly, the usual "Christmas winds" as the Barbadians call them. A drive of 2½ miles to the north-east of Bridgetown, through cultivated country, where we saw on every hand little save sugar-cane, brought us to a small wood and a winding gorge or gully near the estate buildings, which could not have been more than 150 or 200 ft. above the sea.

Here I saw my first Neotropical butterflies, but *Precis lavinia*, Cram., and *Callidryas eubule*, Linn., f. *sennae*, Linn., might have been Oriental forms, *lavinia* being a characteristic *Precis*, and *Callidryas* being extremely closely allied to *Catopsilia*. Of the former I managed to secure two examples, both males, one "wet," the other "dry." The species appeared to be rather common, settling on the ground, or very near it, with wings spread out but often flapped. It was too windy to judge of orientation. The Brimstone was also

common, and I secured two of each sex; the males had a strong scent, which both my wife and I compared to *Stephanotis*. The males were "wet," but the females were partly "dry" in character, thus conforming to the Old World rule that the dry-season coloration is more persistent in the female, possibly because the female life being the more valuable stands more in need of protective colouring. The females had a fainter sweet smell, certainly disagreeable and suggesting pomade. When a cloud passed over the sun, a female *Callidryas* was seen, after some looking about, to settle upon a yellow leaf of the Life Plant (*Bryophyllum calycinum*, Salisb.).

But if the Nymphaline and the Pierine presented no conspicuous new features, it was not so with the Skippers. *Eudamus proteus*, Linn., *is a robust insect, nearly black with whitish markings*, glossed over with a curious brassy-green, but even more remarkable are its long broad tails. It was quite common in the little wood, resting on the *Lantana* flowers with its wings up and half open.[1] It was here, by the way, that I first saw *Lantana camara* in its native province, less luxuriant than in the East, curiously enough, and with smaller flowers. Amongst the *proteus* I found two specimens of *E. santiago*, Lucas, making in all four species of butterflies, which I am told may be regarded as a goodly number for an island with such a poor fauna.

I kicked up a very worn example of the common West Indian Noctuid *Poaphila immunis*, Guen.

The flowers of a species of *Ipomoea* attracted a few Honey-bees, *Apis mellifica*, Linn., f. *ligustica*, Spin., as well as the small grey *Centris nitida*, Smith.

Sweeping grass and mixed herbage yielded the Bugs *Nezara marginata*, Beauv., a green insect, and the brown and green *Edessa meditabunda*, Fabr., together with some unnamed Acridians, and a Spider with a beautiful silvery pubescence. A rotten calabash fruit was swarming with a little Nitidulid beetle of the genus *Stelidota*. Several Dragon-flies are still unnamed.

Mrs. Longstaff was much interested by finding in the gully several eggs of the big *Bulimus oblongus*, Müll. They were white, calcareous, and almost as large as sparrows' eggs. Dead spires were present on all sides, but the only live Mollusc seen was about half-grown. While poking about in the gully, I came across two large Toads and a beautiful blue and green Lizard.

It was most satisfactory on returning to the ship to realize that in such a flying visit I had proved the scent-bearing properties of

[1] See below, p. 289, Fig. 10.

Callidryas to resemble those of *Catopsilia*, and had seen the yellow butterfly choose out a yellow leaf as a resting-place.

SECOND VISIT. April 16th.

When homeward bound we got part of another day ashore at Barbados.

This time, after again going through the necessary ceremony of eating flying-fish, we drove over to Oistin Bay on the south coast, passing through country that reminded me of the Sussex downs about Rottingdean—the paucity of trees, the bare wind-swept downs, the white (coral) roads, the churches nestling here and there in sheltering hollows, drawing round themselves a screen of stunted trees—all recalled our own South Coast. It is needless to say that the cultivated open Barbados of the twentieth century bears little resemblance to the island which we occupied in the seventeenth—an island clothed with dense tropical forest. Following the instructions of Mr. H. F. D. Bartlett, F.E.S., we left the carriage at a point on the shore between two houses named "Dover" and "Calais." There, as he had told me, the small Tiger-beetle, *Cicindela hebraea*, Klug (*? saturalis*, Fabr.), coursed rapidly over the ground; it was very wary, and hard to follow over the glaring white sand, so that it took some time to collect four.

A neighbouring Sea-grape (*Coccoloba uvifera*, Jacq.) harboured various Aculeates: *Apis ligustica*, an *Odynerus*, and the long, pale-yellow Scoliid *Dielis dorsalis*, Fabr., of which I got males only. A few Flies are still unnamed; the same remark applies to some Dragon-flies.

We did not see a single butterfly that day—our last in the West Indies.

TRINIDAD, lat. 10° 45′ N.

December 19th, 1906.

If Barbados is somewhat commonplace, nobody could say that of TRINIDAD. The steep mountain-sides, draped with rich vegetation to the very water's edge, seem to suggest a new world, and the romantic feeling is increased as the ship passes between the islets which almost close the Bocas, and the Gulf of Paria opens to our gaze. Neither a Spanish galleon nor a Carib canoe would seem out of place round yonder rock.

The Harbour Master, himself an entomologist, was good enough

to take us ashore in his launch. The temperature and the general look of things were tropical without question, in every garden stately palms rose above a wealth of flowers. After a glorious breakfast at the Queen's Hotel, we drove to the Maraval Waterworks, making acquaintance on the way with the large orange pods of Cacao growing out of the trunks of the trees in a surprising manner.

Near the reservoir was a flowery bank so rich in butterflies that in a very short time I captured eighteen species. Perhaps I got hotter than I had ever been in my life, but the sense of hurry, the desire to make the best of the flying hours, was far more trying than the heat. Here I saw my first Humming-birds, two species, one of them of a beautiful metallic green.

The somewhat dull and uninteresting *Euptychia hermes*, Fabr. (*camerta*, Cram.), is recorded in my note-book as common in partial shade, but I had time to take one only, and the same may be said of the white-striped *E. hesione*, Sulz. Far more interesting to me were my first Heliconiines. Of *Eueides aliphera aliphera*, Godart, I took a female, and noted that it had a slow flight, also a peculiar scent, which was strong, and compared at the time to that of acetylene; moreover, it was tenacious of life. Of the far more exciting scarlet and black *Heliconius amaryllis euryades*, Riff., I took a male, which also had a peculiar but rather pleasant scent. Another long-winged butterfly, after being duly pinched, got up and flew a long distance, giving me a hot and exciting chase. I brought it safely back to the hotel, and noted that it had no scent, but by some misadventure it was lost afterwards. From recollections I am disposed to think that it was *Tithorea megara*, Godart, a well-known Trinidad Ithomiine.

The best represented group was the Nymphalinae, and among them the commonest was *Anartia jatrophae*, Linn., a member of a Neotropical genus allied to *Precis*; *jatrophae* is a grey-brown butterfly with a somewhat ghostly flight, it settles on the ground, and was seen to orient with tail to the sun; *A. amalthea*, Linn., is much more showy, being black, scarlet, and white; it flew near the ground, frequenting damp ditches, and settled with wings three-quarters expanded, orienting somewhat indecisively. *Adelpha cytherea*, Linn., with similar habits to the latter, seemed to have a slight pleasant scent, though I was not sure of this. *Phyciodes leucodesma*, Feld., a smaller insect, was also rather common, it has a gliding flight like that of the Old World *Neptis*, which it somewhat resembles also in its black and white colour-scheme.

Callidryas eubule was not common, but I took a wet-season male, which had a strong scent, suggesting *Stephanotis*, though less agreeable. *Terias* (*Eurema*) was represented by one *albula*, Cram., and two *nise*, Cram. One of the latter, an intermediate male, possibly had a slight scent, the other, a large wet-season female, certainly had a slight sweet scent, which my wife confirmed. Of *Daptonoura lycimnia*, Cram., which appeared to be rather common, I secured two males, both with a strong, sweet, flowery scent, perhaps like that of *Freesia.* I managed to get one example, a male, of the very characteristic *Enantia (Dismorphia) licinia,* Cram., of the Trinidad form *acutipennis.*

A female *Papilio cymochles,* Doubl., was the sole representative of the group; it had a somewhat musty odour.

The Skippers were represented by single individuals of *Cecropterus aunus,* Fabr., *Hesperia syrichthus,* Fabr., and *Prenes nyctelius,* Latr., as well as a pair of *Vehilius venosus,* Plötz.

Naturally enough in the enthusiasm caused by my first introduction to the South American butterfly fauna I had no time to devote to other orders, yet two or three things that obtruded themselves were taken, such as the Honey-bee, *Apis ligustica*; the variable Bug, *Hypselonotus fulvus,* De Geer; an Ant, and a bright, yellow-green Acridian of very cryptic habit found sitting on the underside of a leaf of one of the *Melastomaceae,* when it was touched, much dark liquid, soluble in water, exuded from its mouth.[1]

So ended an all too brief glimpse of Trinidad, an island which, whether looked at from the point of view of geography, geology, or natural history, clearly forms part of Venezuela, and cannot be considered as one of the Antilles.

La Guaira, Venezuela, lat. 10° 45′ N.

December 20th, 1906.

The R.M.S. "Tagus" entered the small harbour of La Guaira about midday. La Guaira is a name that gets into the papers now and again when the tortuous politics of Venezuela try the temper of Europe or America more than usually, but in the minds of most people it is associated with Kingsley's great romance. We had heard it spoken of as the Aden of the Caribbean Sea, but we found it much less hot than we had expected.

The elaborate formalities of the officials kept us from landing

[1] Compare *Phymateus* in South Africa, p. 204, *supra.*

until the afternoon was far advanced, and a mantle of heavy clouds had descended from the mountains, which seem to overhang the town. There was nothing for it but to watch the grey Pelicans fishing, or to look up at the mouldering fort above, and then down again to the equally mouldering gunboat in the harbour, and moralize over the fall of the Spanish power and the unlimited capacity of the Spanish-American for bad government.

When at last we set foot upon the Spanish Main we found the streets were muddy, and that there were all the signs of much recent rain. A push was made to the most promising spur, a little to the west, where a fair number of butterflies were seen, though few were taken. The extremely steep and slippery slopes appeared to consist of bright red clay scantily clothed with small bushes, amongst which a species of *Cistus* predominated. Pursuit was almost out of the question, and operations were not facilitated by the well-meant attentions of some small Indian boys.

On examination at home my captures proved to be *Ithomia iphianassa*, Dbl. & H., an insect of thoroughly South American type; *Ageronia ferentina*, Godart, and *Tmolus cambes*, Godm. & S., one of each. Of the last-named Mr. H. H. Druce informs me that the type came from Mexico, and that it has not previously been recorded south of Guatemala. It had a scent which my wife described as that of coarse brown sugar, while I compared it to treacle. There were also a worn specimen of *Sphaenogona gratiosa*, Dbl. & H., two of *Terias albula* (one of them having the black border of the hind-wing unusually pronounced), and two of the Skipper *Heliopetes laviana*.

With these butterflies were a very few insects of other orders. Of several Grasshoppers there was one so coloured as to resemble the red soil. A large but dingy Bug, *Acanthocephala affinis*, Walk., made up for deficiencies in colour by its remarkably enlarged tibiae. A Lady-bird, *Hyperaspis connectens*, Thunb., was obtained by sweeping close to the sea. A large white, black-barred Pyrale, *Ledereria nilckenialis*, Snell., was also taken.

A bare muddy slope fully exposed to the sea-winds could not in reason be expected to yield a very rich example of the Neotropical fauna, more especially late in the afternoon; nevertheless, I returned to the ship with some feeling of disappointment.

SAVANILLA, COLOMBIA, lat. 11° 10′ N.

December 22nd, 1906.

Having a few hours to wait at this miserable port, we determined to investigate some low wooded hills a little to the west of the pier. This pier is rather a poor affair, a mile in length, and the wind was so high as to make walking along it somewhat nervous work. The captain told me that a German steamer had gone right through it not long before. On reaching the land we struck off to the right along the shore for a mile or so, and then turned inland into a scrubby forest. A high wind was much against collecting, and the sunshine was intermittent. We found the forest dry in the extreme, all vegetation parched and run-to-seed. The seed-vessels seemed to be endowed with every provision of nature to ensure their distribution; burrs of every sort and kind tangled up the net into a hopeless mass, and when I got back to the ship my flannel trousers were plastered over, so that it took half an hour to remove the adherent vegetable matter; the most troublesome foe was a small pod which adhered by invisible hooks, and on trying to remove it broke up into several sections. Never again will I wear flannels in such a place.

The most exciting beast that we came across was an Iguana, a lizard nearly four feet long, which ran off like a rabbit. Mrs. Longstaff also saw a large Snake.

Butterflies were comparatively scarce, and I secured but twelve species. The commonest by far was the black and white Skipper, *Heliopetes laviana*, and next in point of numbers came its white congener, *H. arsalte*, Linn.; with them I took two of the pretty little *H. domicella*, Erichs. Other Skippers, though less taking in appearance, were of better quality, viz. *Thymele grenadensis*, Schaus, of which I saw several, but only captured one in very poor condition; and *Vehilius illudens*, Mabille, of which the specimen brought home was the only example seen during the whole tour; it was taken on the seashore.

The only Nymphalines were one *Cystineura cana*, Erichs., and three of the little *Phyciodes frisia*, Poey.

The Erycinid *Hamearis erostratus*, Hew., not unlike our *Nemeobius lucina*, but with the habits of *Chrysophanus phlaeas*, was not uncommon. *Catochrysops hanno*, Stoll, was the only Blue seen.

Two large males of *Callidryas sennae*, both "wet," had a strong scent like that of *Freesia*. I took a very worn specimen of what would appear to be *Sphaenogona gratiosa*. *Terias* was represented

by two *delia*, Cram., f. *lydia*, Feld., having the longitudinal black stripe very broad. One of them, a male, was "wet"; the other, of the opposite sex, intermediate, inclining to "dry."

A solitary Geometer perhaps should be referred to *Flavinia*.

A Dung-beetle, *Onthophagus marginicollis*, Harold, taken on the wing, was all that I saw of the great order Coleoptera.

A *Podalirius* that I took was not to be found in the National Collection, and remains in Mr. Meade-Waldo's hands. There were several Wasps, for it is never quite too dry for them: *Polybia nigra*, Sauss., and a pale-red species of the same genus; the handsome orange *Polistes versicolor*, Oliv.; while on the sand near high-water mark two *Monedula signata*, Linn., were found.

We tried to work our way round a small hill, and so back to the pier by another route, but lost ourselves among the winding tracks, and finally had to try back about a mile to an Indian's hut. The mistress thereof was very imperfectly arrayed in a single skimpy garment, much the worse for wear, which declined to cover the whole of her person at one and the same time. A long conversation, partly conducted in bad Spanish, partly in Portuguese, took place, and it was at last arranged that a little girl of eight should be our guide. This child, as a rule, it would seem, dispensed with clothing entirely, but this was a very special occasion. Accordingly she retired with her mother into the recesses of the hut, from which she presently emerged resplendent in a smart white muslin frock, though otherwise her attire was simplicity itself. This up-to-date young lady put us back on the road by which we had come, and we had to retrace our steps.

At Savanilla we parted from pleasant travellers, English and Spanish, who had sat at our table. They were bound for Bogotá by way of the Magdalena River, and said that Savanilla was exactly halfway in time between London and Bogotá. How I should have liked to have accompanied them to that justly celebrated butterfly hunting ground!

I may here remark that I was greatly struck by the extreme softness of Spanish as spoken by South American gentlemen.

Savanilla.

SECOND VISIT. March 15th, 1907.

On our return journey we again landed at Savanilla for a short time, and on this occasion turned to the left, and collected about the mouth of a small river. The chief attraction was the Black Mangrove

(*Avicennia nitida*, Jacq.); at its flowers were several Blues, *Catochrysops hanno* being the commonest; of *Callicista bubastus*, Cram. (*salona*, Hew.), the tail-less form, and of *Chilades exilis*, Boisd., two each were taken, but of *Thecla hazia*, Hew., one only. A *Precis lavinia* and a *Terias delia*, a dry-season female, complete the list.

But those same insignificant-looking Mangrove flowers attracted a number of insects of other orders, many of which still await determination. As might have been expected, Hymenoptera predominated: a tiny *Megachile*, near *peruviana*, Smith; a number of an unnamed *Melipona*; a green *Augochlora*; *Polybia occidentalis*, Oliv., and *P. nigra*, Sauss.; the grey, red-tailed Sphex, *Harpactopus thomae*, Fabr.; *Tachytes amazonum*, Smith, var.; and *Microbembex sulphurea*, Spin. Conspicuous, however, among all these was *Pepsis equestris*, Erichs., a magnificent insect nearly 2 inches in expanse, of a blue-black colour, all except the basal third of the fore-wing, which is a dead white. They were easily frightened off the flowers, and were swift of flight, but I managed to net a couple.

It may be remarked that the Mangrove belongs to the Natural Order *Verbenaceae*, of which so many members are especially attractive to insects.

From the river were obtained a *Ranatra unidentata*, Stål, and a water-beetle, *Cybister laevigatus*, Brullé. On the sand just above high-water mark were a number of highly cryptic Acridians.

Living in Colombia is not so expensive as the sight of the first bill might suggest: the paper dollar is so depreciated as to pass for a cent; a fact not easy to realize.

CARTAGENA, COLOMBIA, lat. 10° 25′ N.

December 23rd, 1906.

We entered the beautiful land-locked harbour of CARTAGENA DE LAS INDIAS in the early morning. How different must have been the whole look of the place in 1585 when it was sacked by Drake! and yet again how different when the muddling and quarrelling of Vernon and Wentworth led to the disaster of 1741!

The fine situation remains, but the city itself bears to-day a forlorn and abandoned look. The chief merit of the cathedral is its size, both within and without it suggests poverty and neglect. One cannot but rejoice that the famous—or rather infamous—Inquisition is no more, but it is a pity that the building was not suffered to stand as a monument. I have seen no volunteers so ill-drilled and unserviceable in appearance as the sorry soldiers of Colombia. The

guardship has been run into the shallows to prevent it from sinking at its moorings.

It was very hot that morning, and everything had a dry, burnt-up look as I tramped through the dust to La Popa, a wooded fort-crowned hill about 400 ft. in height, whence is a magnificent view, showing as on a chart, the singular distribution of land and water, with the city standing on a spit, washed on the one side by the ceaseless surf of the Caribbean Sea, on the other by the placid, mangrove-fringed waters of the lake-like harbour.

I netted two of the many *Callidryas sennae* that were coursing about, one of each sex; the male had the usual strong *Freesia* scent, the female a disagreeable, but somewhat sweet odour. The male was large and decidedly "wet," the female might better be described as intermediate, inclining to "wet." *Sphaenogona* (?) *gratiosa* was rather common, flying through bushes close to the ground, but in my hurry I secured one female only; *Cystineura cana*, with its slow gliding flight near the ground was also somewhat common, showing a partiality for shady spots. Of the Erycinid, *Hamearis erostratus*, several were seen, again reminding me of a Small Copper in its ways; another Erycinid was also met with, *Nymphidium molpe*, Hübn., of which I took a female.

Only two Blues were captured, *Leptotes cassius*, Cram., and a female *Thecla* that would appear to be *vibidia*, Hew., though Mr. H. H. Druce says it is impossible to speak with certainty.

The only *Papilio* was a worn specimen of the somewhat dull *P.* (?) *serapis*, Boisd., others were seen in shady places.

Two males of *Danaida* (*Tasitia*) *eresimus*, Cram., and a solitary Skipper, *Hesperia notata*, Blanch., make up the ten species brought home from that hot and hurried walk. Two Dragon-flies found among the Mangroves have not yet been determined. It was hard to tear one's self away, and very hot and very dusty was the last passenger to go on board, where he found that he had somewhat tried the feelings of his wife and the temper of the captain.

COLON, PANAMA, lat. 9° 20' N.

We arrived off COLON on the morning of December 24th, but could not go in as a pretty stiff "Norther" was blowing, and the quay is quite open to that quarter. The miserable alternative was to stand off and on all day, going dead slow in a somewhat rough sea.

On Christmas-day there was no change, and our monotonous occupation was unbroken. Among the passengers was a young

Trinidad lady, accompanied by her married sister. She was to have landed the day before in order to be married at noon to a young fellow employed on the canal works, who had been granted two days' leave of absence for this very special purpose. Fortunately the bride-elect took chaff well, for she got plenty of it. Fancy the would-be bridegroom returning to his work without a wife!

At dinner we did our level best to be merry, but the attempt was only partially successful.

Boxing-day found us anchored off Colon. The wind had not abated, and after watching the big waves breaking on the quay for some hours we weighed anchor and set off for the old harbour of Puerto Bello, some 20 miles to the northward. The entrance is narrow, with rocks on either hand, and thrice we essayed to enter, but each time as we drew near a heavy rain-squall obscured everything, and we had to sheer off, finally putting out to sea again for the night.

December 27th. After a very rough night outside, we woke to find ourselves just off the entrance, and got in before breakfast, passing between cruel-looking rocks on which the waves were lashing themselves in a fury of rage.

Puerto Bello, which gave its name to Portobello near Leith, is a tiny port like a tropical Dartmouth; quite land-locked, its steep shores covered with forest which overhangs the water, it looks like the most peaceful and secluded of lakes. The town has almost disappeared, the fortifications that Vernon destroyed in 1739 have been long dismantled, and are in great part draped with creepers. I would much have liked to land, but no boats put off, moreover it rained steadily most of the day. We shared the anchorage with three vessels wind-bound like ourselves.

As the wooded shores were only half a mile away on either hand, and the wind was but trifling in the sheltered harbour, it is not surprising that a number of insects came to the ship's lights, and a very interesting lot they were. The creature which interested me most at the time was a Neuropteron with conspicuously clubbed antennae, presumably a species of *Ascalaphus*, a curious genus that I have not come across alive either before or since.

The sole Geometer, *Anisodes placidaria*, Guen., is in effect a tiny *Ephyra* [near *pendularia*]; *Selenis suero*, Cram., and *S. lanipes*, Guen., are Quadrifid Noctuae [of which the former has a wing pattern like our *Hemerophila abruptaria*]; *Aluaca laxea*, Cram., a chocolate-coloured moth with a round pale spot on the fore-wing belongs to the same group, and all three are very distinct from anything

Palaearctic. Another Noctuid—they were all single specimens—was a most distinct and beautiful insect, in superb condition, white with blue-grey and dark-green markings. Sir George Hampson has described it as *Hoplotarache viridifera, sp. nov.*; the type is a female, it belongs to the sub-family *Erastrinae*[1] [Plate III., Fig. 5]. Then there was a Limacodid, *Eulimacodes distincta*, Möschl., presumably scarce, since the National Collection has to be content with a drawing of it, and a Sphinx, *Aellopus fadus*, Cram. Another specimen of the last-named had come to the ship's lights the night before, soon after we had left the Colon anchorage, and this in spite of the strong wind blowing on to the land.

At last, after knocking about outside for four days and nights, we tied up alongside the wharf. Such an experience, only too common in the old days of sailing vessels, is now quite exceptional. The most curious circumstance was that in spite of a persistent northerly gale and heavy sea, the temperature in our cabin throughout the whole time ranged from 80° to 85° F. It was especially trying at night, for when we steamed slowly with the wind aft for an hour or two, the air would be perfectly stagnant in the cabin as one lay close under the open port, with no covering save pyjamas, yet naturally in a profuse perspiration. At last one would fall asleep, to awake shivering in a gale of wind, for the ship having changed her course was now steaming on her own wake against the wind. This process was repeated again and again.

On landing, every one was presented with a circular, setting forth in English and Spanish the danger of mosquito bites, signed by that famous sanitary reformer, Colonel Gorgas, of the United States Army.

Colon is quite the most wretched place that it has been my fortune to visit. The houses of the Negroes stand on piles in the swamp; and in one place I saw a notice-board setting forth the eligibility of a building site, more than half of which was covered with several inches of water. The more recently erected houses for Europeans, and the barracks for canal labourers, are all enclosed with wire netting, and look like gigantic meat-safes. Originally the town bore the name of the railway promoter Aspinwall, but he had to give place to the great Genoese navigator. At Colon Lesseps buried a great reputation.

A short mile from the town is some rising ground, not 100 ft. high, known as Monkey Hill, otherwise Mount Hope. This, the sole

[1] "Lepidoptera Phalaenae," vol. x., 1910, p. 716 (No. 6083), Pl. CLXX. Fig. 32.

really eligible site anywhere about, is for the most part devoted to the famous cemetery which the Americans are now getting into order. On asking an official how many had been buried there, I was told, "Anywheres between 300,000 and 500,000." No one will ever know the number of lives laid down in the making of the railway, and in Lesseps' futile work on the canal. It used to be said of the former that every sleeper cost a life. It is distinctly gruesome to see graves waiting for occupants, and a shed full of coffins by the gateway kept in readiness!

The Americans have done marvels, and their praiseworthy efforts have met with a quite astonishing measure of success. Nevertheless as a student of vital statistics I must protest against the unfairness of comparing the death-rates of a selected population of labourers in the prime of life, with the mixed population of the old city of Panama. Some of the official reports of the health of the Canal Zone savour too much of the quack advertisement.

The tragic ground of Mount Hope was a great resort for butterflies. *Danaida archippus*, Fabr.,[1] spread its big wings in leisurely flight; both sexes had a scent, that of the male being scarcely disagreeable, but that of the female was compared at the time to rabbit-hutches, or musty dry dung.

The prevalent Nymphalines were the grey *Anartia jatrophae*, and the more showy black, cream-colour and crimson *A. fatima*, Fabr., which glides about quite close to the ground, passing through and under the vegetation; *Precis lavinia*, the wet-season form, could scarcely be described as common. A few of the fine, pale grey *Peridromia feronia*, Linn., were seen to settle head downwards on the silvery trunks of palm trees; though very cryptic they were shy and easily disturbed, flying strongly but returning again and again to the same trunk. This butterfly is interesting as having attracted the special attention of Darwin, but I regret greatly that I had forgotten the passage,[2] otherwise I might have listened for the noise which it makes during flight, and seen it *run* upon the tree trunks. Quite unlike any of the preceding, *Euptychia hermes* flitted gently about, never going more than a few yards at a time. *Callidryas sennae* was to be seen flying strongly as usual; a male of the

[1] American entomologists call this insect *D. plexippus*, Linn., but the type, though stated to have come from America, has a white transverse bar, and is unquestionably *D. genutia*, Cram. Throughout this book the Oriental species, with the white bar, is called *D. plexippus*, Linn., and the American (and widely spread) species without the white bar, *D. archippus*, Fabr.

[2] "Journal of Researches," etc., ed. 1860, p. 33. Compare my observations at Trinidad, pp. 324, 325, *infra*.

wet-season phase had a very strong, rich, *Freesia*-like scent, both when alive, and at home dead ; but the prevalent Pierines were *Terias delia*, wet-season specimens of the form *lydia* (4 ♂, 1 ♀) and *T. nise* (1 ♂, 3 ♀), all, save one female which was "dry," of the wet-season form. One of the *T. lydia* appeared to have suffered a symmetrical injury to the hind wings.

Catochrysops hanno, the only Blue met with, was tolerably common. Skippers, however, were much to the fore—the long-tailed *Eudamus catillus*, Cram.;[1] *Megistias labdacus*, Godm., and *Hylephila phylaea*, Drury, looking very golden on the wing; commoner than these was the white *Heliopetes arsalte*, dashing about in all directions ; and still commoner was *Hesperia syrichthus*.

A Labiate plant (*Hyptis capitata*, Jacq.) was attractive to Aculeates and Flies ; among these were the grey-black, purple-winged Social Wasp *Synoeca cyanea*, Linn., var. *ultramarina*, Sauss., *Melipona amalthea*, Fabr., and *Apis ligustica*, together with some Syrphids. Two other wasps—*Monedula signata*, Linn., and a *Crabro*—were taken on the wing. Sweeping produced a few Beetles—*Euryscopa cingulata*, Latr., *Oedionychis* 10-*guttata*, Fabr., *Homophoeta aequinoctialis*, Linn., and *Ceratoma ruficornis*, Oliv. With these was a neat black and cream-coloured Bug, *Hypselonotus concinnus*, Dall., which is white underneath.

It surprised me greatly that the only insects visiting the ship's lights at the quay were a number of Muscid flies of the blue-bottle type.

There was a heavy shower on the morning that we landed, and very heavy rain was reported for November and December.

JAMAICA, lat. 17° 45′ N. to 18° 35′ N.

December 31st, 1906—March 8th, 1907.

My first view of JAMAICA was in this wise. It was the last day of the year, and I went on deck at 5 a.m. To the west the moon shone brilliantly over a smooth sea, just above her was Jupiter. To the east Venus positively blazed out, as yet undimmed by the dawn. To the south α and β Centauri pointed to the Southern Cross. To the north the outline of the Blue Mountains was faintly traceable. . . . As I gazed on the wondrous scene it all gradually changed, everything seemed to dissolve until the rising sun proved Jamaica to be quite close to the ship.

[1] See the cover of this volume.

Right ahead, lying abreast of the shore and well in the breakers, almost alongside the light-house, was the wreck of the huge Norddeutscher Lloyd "Königin Luise," a handsome new ship painted white. Her skipper ingloriously blew out his brains within a quarter of an hour of striking, and before he had landed his passengers!

As we passed the reef at Port Royal we were told of the great earthquake of 1692, when it is said that Port Royal, for its sins, was engulfed and 3000 persons perished. We were also told of houses and churches that might be seen deep down in the harbour.

When walking in Kingston the poor quality of the buildings struck me, and recollections of my chairmanship of the Building Act Committee of the L.C.C. made me say to myself that Kingston greatly needed a Building Act; but this was only a passing thought, for was I not on entomology intent?

It is needful to bear in mind that the aboriginal forest in Jamaica has in most places disappeared long ago, and that in the palmy days of the island the land was covered with sugar estates. The area under cultivation has, however, greatly shrunken since then, and much of the land is now covered with forest of second growth, termed in Spanish *rastrajo*; but land that has gone out of cultivation is in Jamaica officially described as *ruinate*—a sufficiently expressive term. As in other quarters of the world, this second growth is, for the most part, of poor quality and consequently little worth; moreover, it is often smothered with a pall of creepers, chiefly species of *Convolvulus* and *Ipomoea*. Two of these Bind-weeds, with bright yellow flowers, are most effective, but at the time of my visit all, or nearly all, were dead and gone-to-seed, and the general appearance of the *rastrajo* was most untidy, and even depressing. If Jamaica has given to the East two vegetable plagues in the shape of *Lantana camara* and *Mimosa pudica*, Africa has in retaliation given to Jamaica *Thunbergia alata*, a well-known green-house creeper, of which the commonest variety is orange with a dark eye, though another variety is paler, with a green eye. This creeper now covers the hedges in Jamaica, and invades the ruinate lands, making a strong fight of it with the indigenous bind-weeds.

Though there are many Coco-nuts in some districts, it cannot be said that Palms are a striking feature of the vegetation. Speaking generally, trees of any size are loaded with Epiphytes of many kinds, chiefly members of the Natural Order *Bromeliaceae* (which includes the Pine-apple), but also many Orchids. The trees which we most admired were a marked contrast to one another—the Bread-fruit

(*Artocarpus*), with its large, rich dark-green shining leaves, and the stately *Erythrina*, or Coral-tree, whose scarlet flowers contrasted exquisitely with its leafless, silvery-grey stems against the background of bright blue sky. Ferns of all sorts and sizes, from tree-ferns downwards, are met with in the greatest variety and profusion. Oranges were but a penny a dozen, and at one place we had a quite distinct sort at dessert every day for a week. The Sweet-bitter orange is most refreshing, and makes excellent orangeade. Tangerine oranges are comparatively dear, only six going to the penny, but they are the best that I have ever tasted. The Star-apple is good, but covers the lips with india-rubber. The Sour-sop is unrivalled as a constituent of ice-creams. A wide extent of country is devoted to the growth of Bananas, largely the result of American enterprise and the patient labour of Indian coolies.

I do not remember seeing any snakes in Jamaica, but the fierce little Mongoose which was imported to destroy them was not infrequently seen. It is said that the mongoose soon found it easier to eat the eggs of ground-nesting birds than to hunt snakes. To this change of diet is attributed the extraordinary increase in the number of Ticks, since the said ground-nesting birds are believed to have preyed upon the ticks at some period of their life. Whether these statements give a correct account of the matter I know not; but, be that as it may, the ticks are a perfect nightmare, and the fear of them often prevented me from going into likely places in search of Lepidoptera.

It is impossible to write of Jamaica without mentioning the Humming-birds. They were especially common in the gardens of the King's House outside Kingston. Their tameness surprised me; by standing quite still you might see a humming-bird visit several flowers on a bush, and then perch on a twig but two yards off, looking at you just as a robin might; after resting for a few seconds, the tiny creature would visit three or four more flowers, to return again to its perch, and this would be repeated indefinitely. Doubtless the exertion of feeding on the wing is considerable.

Once I caught a humming-bird in my net, and ran perhaps fifty yards to show it to my wife, but it had knocked out so many of its feathers during that short time that I did not repeat the experiment. Among the flowers that I saw them visit were species of *Hibiscus* and *Convolvulus*. A different species, green in colour, visited the tiny Composite flowers of the *Distreptus spicatus*, Cass., while yet another species was seen to enter the gigantic white flowers of the *Beaumontia grandiflora* and *sit down* in them. The *Distreptus* is very attractive

to insects (especially to Blue butterflies), and the humming-birds might visit the flowers to catch them, but it is scarcely conceivable that they could extract honey from such minute flowers. At Mandeville, however, I saw my sole specimen of the somewhat scarce "Doctor" (*Trochilus polytmus*), which has two long battledore-like tail feathers, and watched it feeding at the flowers of the Life Plant (*Bryophyllum calycinum*, Salisb.). These flowers are tubular, but the mouth is much contracted, and the birds bored holes near the base of the corolla just as bumble-bees do; many of the flowers were found to be pierced. This operation, I take it, must have been associated with honey-gathering, but Dr. A. R. Wallace seems to think that humming-birds are almost exclusively insectivorous. Another day I saw the common green species visit the Life Plant, but have no note of its mode of feeding. A black species was seen at *Lantana* flowers. In the garden at Walderston a small humming-bird visited a *Tropaeolum* flower within a yard of my elbow. At Port Antonio a tiny species was seen at the small Labiate flowers of a species of *Coleus*, also at those of Vervain (*Stachytarpheta*).

The Great Earthquake.

The morning of January 14th, 1907, was passing fair, in a land where fine mornings are the rule. I went out collecting a little to the east of the Constant Spring Hotel, and remember well, after digging a number of beetles, *Scalmus interstitialis*, out of a rotting log, coming across several of the beautiful green and black butterfly, *Victorina stelenes*, sunning themselves on mango leaves, but I had to hurry back to lunch, having arranged to go into Kingston with my wife. We went by the electric tramway and noticed that it was exceptionally hot, though, perhaps, scarcely as hot as on the previous day. When we reached Harbour Street the clock was almost on the stroke of three, and, having arranged to meet Mrs. Longstaff in the museum at four o'clock, I ran to the Colonial Bank, and was just in time to get in before the doors closed for the day. By the courtesy of the teller I drew the money that I required —it was the last cheque cashed in that building. From the bank I went to one of the principal stores with two new white drill coats that fitted badly; they assured me that I should have them back the next day—but the store was burned down in the course of that fateful afternoon.

From Harbour Street I repaired to the old Mico building in

Hanover Street, in which the meetings of the Agricultural Conference were held. This was an old brick building, formerly a college, better built than most in Kingston. It was roofed with tiles, and approached from the street by over a dozen rough brick steps, unusually steep, and not provided with a hand-rail. Within that building were sitting the Governor of Jamaica with his chief officers; representatives, official and other, from all the Antilles; the Archbishop of the West Indies, and other local celebrities; Sir Alfred Jones and representatives of the Colonial Office. It is not too much to say that a great part of the brains of the British West Indies was debating under that roof and was, I believe, in a fairly optimistic frame of mind as to the prospects of the colonies.

Wishing to speak to an old friend, Mr. A. A. Pearson, C.M.G., who, as a representative of the Colonial Office, had arrived from England but a couple of days before, I went up the steps and stood in the lobby looking through the open door, and waiting until the gentleman then addressing the meeting should sit down.

Suddenly, without one moment's warning, the building shook, and there was a sound as of tiles falling from the roof, though I did not see any fall. At once I said to myself, "The earthquake I have so often wished to experience! What a pity it is such a slight one!"

Calling to mind the proverbial advice to get out of a building as quickly as possible, and especially fearing that I might be hurt if a stampede took place, I made my way to the door. Not relishing the look of the steep steps, I stood for a moment to one side, but quickly realizing that if anything came down it would probably be the portico under which I was, I thought the steep steps the lesser evil of the two, and rushed for them, expecting every moment to be pushed down by those behind. I was barely half-way down when the anticipated occurred, for I seemed to be pushed from behind in such a way as to be turned round in the air, going down the rest of the steps on my back and landing in the street on the top of my head! To my great surprise I was not seriously damaged, for a slight scalp wound was of trifling consequence. When I regained my feet the members of the Conference were leaving the building "in good order," and I did not see that the building itself was seriously affected. Up to that time I did not in the least realize that anything very terrible had happened. I said to a gentleman near me, "You have been down too; I will dust your back and you can dust mine." Mr. Pearson came up, and it was arranged that Mrs. Pearson should dine with us—"barring more earthquakes," he called out after me, as I was setting off to look after my wife.

I may here remark that on mature reflection I came to the conclusion that I had not been pushed from behind, but had been thrown down by the final effort of the shock, which it was generally agreed combined an *upward* thrust with a *rotatory* movement. Unfortunately I did not hear the Archbishop's celebrated speech: "Now, gentlemen, let us keep our seats"—a remark which appeared unkind to Mr. Pearson who had been thrown out of his.

The museum is perhaps half a mile from the Mico building, and it was quickly evident that the shock had been far more severe than my first impression led me to believe. There were ruins on every side; in places masses of fallen brickwork had to be clambered over. Everywhere panic-stricken blacks were making for the country as fast as their legs could carry them; they screamed and called loudly on each Person of the Trinity in turn: it was as if all the inmates of a large lunatic asylum had been turned into the streets.

Hurrying on as quickly as the obstacles would permit, I was soon relieved to see my wife unharmed standing in the street surrounded with fallen buildings. She described her experiences in these words:—

"I was in the museum, and, having seen the objects on the ground floor, started to go upstairs. The staircase was built against the outer wall in which there was a window overlooking the street, and as I passed this window the brilliance of the sunshine especially struck me. Suddenly there seemed to be a terrific blow upwards from beneath my feet, accompanied by an awful noise and shaking. I at once realized that it was an earthquake, and a bad one. Turning round immediately, I ran down the stairs and out of the front door. To my horror it had become suddenly dark, for the air was filled with the dust of falling buildings so that I could but dimly see my way. The air was full of falling things, and the fore-court wall to my right hand swayed like reeds in the wind. I found the gate with difficulty, and descending two or three steps made my way into the middle of the street. Though my hat was covered with dust not a fragment of brick had touched me! When the air cleared somewhat a man called out to me: "You had better get out of those wires." Looking down I found there were broken and twisted electric wires round me. Some of the houses opposite had collapsed entirely, others were more or less wrecked. A woman whose head and shoulders appeared out of a heap of ruins could not release herself; in vain I called to one black after another to help her; in one case I offered to hold a man's horse while he did so, but in vain. At last a white man appeared and at once set her free."

Seven weeks later I re-visited the museum. The only specimens remaining were the skeletons of a whale and a crocodile, which, hanging from the ceiling of the lower room, gazed as with a gruesome grin upon the ruins. The upper walls had disappeared and the roof was standing just above the joists of the first floor, having apparently experienced the same rotatory movement as the statue of Her late Majesty Queen Victoria and the writer of this account. Practically the whole of the walls of the upper storey had fallen outwards—many tons of brickwork. That my wife escaped with her life is surprising, that she was unscathed is simply marvellous.

There were other remarkable escapes in the precincts of the museum. A carpenter had just come down a ladder, when the wall against which the ladder was leaning fell outwards. A wall fell upon a cradle which it crushed without hurting the baby within. Another wall fell where a child was feeding some rabbits; the hutch was crushed and the rabbits were killed, but the child escaped.

Mr. Abell, a visitor at the Constant Spring Hotel, who some years before had suffered a sunstroke in India, was watching a game of tennis, when suddenly the lawn appeared to move up and down in waves, like a carpet blown up by the wind. He said to himself: "Gracious me! I have got it again!" Then he saw a huge crack open at the *bottom*[1] of the hotel building and extend upwards to the top, at which he remarked: "Well, *that* is not a sunstroke anyhow." This occurred about six miles from Harbour Street where the damage was greatest.

The earthquake occurred at 3.25 p.m., and lasted about 26 seconds, its effects being aggravated by a destructive fire which greatly added to the horror of the situation. As far as could be ascertained somewhere about 1000 lives were lost. Mrs. Longstaff and I betook ourselves to a surgery to render such help as might be possible, but the first two surgeries we came across were wrecked and deserted. Scalp wounds from falling bricks were very numerous, in some cases extensive and positively appalling to look at, though the negro's head is proverbially hard; there were also many fractures. Shingles from the fallen roofs made better splints than palings, but bandages were a greater difficulty; for the most part one had to make the best of torn-up women's garments, the trimmings serving (with dead grass) for padding. Mrs. Longstaff begged for bandage material from the women, but did not succeed in getting hold of a sheet till late in the day. It was impossible to attend to the cases

[1] I have not been able to think out the nature of the strain which caused this huge crack to run upwards from below.

as fast as they came in, and some very sad ones were altogether past help. There was no laudanum to be had, as every bottle was broken. The doctor's forecourt garden, filled with the injured, was a sad sight. As dusk came on the increasing glare in the sky showed that the fire was approaching, and naturally enough this caused a panic among the poor creatures who could not run away. However, I went out to reconnoitre, and comforted the patients by telling them that the house was cut off from the fire by large gardens. When darkness closed in, and there was but one lamp—by the light of which an amputation was being performed—we had to go: my wife tired out, and myself quite ready for food and drink and rest. I had just secured a cab, by the offer of a sovereign, when we got the use of a private carriage on the condition of taking a patient home and then visiting another.

That night the guests of the Constant Spring Hotel slept on mattresses on the lawn, not daring to stay in the shattered building. It was a lovely night, and the Southern Cross shone out peacefully over the glare of the still burning city. The sensation of feeling mother-earth from time to time shake under one's head, as the numerous after-tremors passed across the island, was as new as it was strange.

The earthquake did not consider people's convenience in any way; thus, a lady at the Constant Spring Hotel was in her bath at the time. This lady's sister was ill in bed, but her husband carried her into the garden wrapped in a blanket. In a private house another lady, the wife of a high official, was taking her siesta; she saw the wall at the foot of her bed waving towards her, so she, very discreetly, pulled the pillow over her head. Then the wall fell—outwards—and the roof followed, but the bed was quietly launched into the drawing-room, the roof falling in such a way that the lady slid down under its cover, and escaped serious injury. It is stated that the front of a house fell out, then the first floor gently subsided to the ground level, and the occupants, two elderly ladies, quietly walked into the street.

I myself saw a house in one of the principal streets looking like a doll's house with the front open. Nothing seemed damaged save the front wall, but that had fallen out. On the first floor was a table set out for a meal, with bottles and glasses untouched. It was more like a scene at a theatre than real life.

These terrifying natural phenomena may, however, be viewed from quite another aspect. Earthquakes may be considered as

Plate III.

AMERICA.

H. and Edgar S. Knight del. West, Newman Chromo

1. PIERIS, sp
2. do UNDER SIDE
3. THECLA NUBES ♂.
4. do. do. UNDER SIDE
5. THECLA NUBES ♀.
6. CRYLLACRIS LONGSTAFFI.
7. HAPLOTARACHE VIRIDIFERA.
8. MYELOBIA PALEACEA.

curative agencies. It is stated on very high authority that more than one bedridden white lady, having been shaken out of her bed, found again the use of her legs.

On landing in Jamaica, Mrs. Longstaff had despatched a postcard to her sister, saying that it was pleasant to be once again on *terra firma*, after such a long voyage: by the irony of events, the card reached its destination at the same time as the news of the earthquake.

A little over two centuries before, on June 7th, 1692, Port Royal, the then capital of the island, over against Kingston on the opposite side of the harbour, was overwhelmed by an earthquake, many of its buildings sinking into what is now part of the harbour, with the loss, it is said, of some 3000 lives. In the interval no shock of any importance had been felt.

Again, in 1907, the permanent disturbance of the ground was far greater at Port Royal than at Kingston. The massive concrete foundations of the batteries subsided, so that some of the guns sank in the sea up to their trunnions. The harbour-master reported notable alterations in the soundings, and when I left several palm-trees near the point were to be seen rising out of the sea. It is, however, noteworthy that the Government buildings at Port Royal withstood the shock wonderfully well; probably they were built in cement. The submarine cable was fractured some 16 miles away.

A sad circumstance connected with the earthquake was the loss to this country of the services of one of its best officials. Sir Alexander Swettenham, K.C.M.G., was compelled to resign, not because he failed to rise to a great emergency, but simply because an injudiciously worded letter, written under peculiarly trying circumstances, was in some unaccountable manner made public, whereas the letter to which he replied has never seen the light. He was practically condemned unheard, to the lasting discouragement of our Colonial service.

About two months after the earthquake, Bishop Joscelyne told me that he had been studying a report of the Diocesan Architect, who had been instructed to examine all the churches in the island, and that it would appear that the greatest destruction had been wrought along a line extending from Kingston in a north-northwesterly direction across the island to Port Maria. Now this is just the line where an extensive earth movement might be expected, where contorted metamorphic strata are found, and frequent intrusions of syenite and porphyry occur.

Though by nature the reverse of courageous, I was, like many

others, not in the least frightened, but was surprised at my own coolness. Also, like many others, I found that the succeeding trifling vibrations disturbed my equanimity more than the initial severe shock. Indeed, a slight but somewhat sustained shock, which I experienced at Mandeville eight days after the great earthquake, produced sensations unpleasantly akin to fear. I seemed to see passing before me in a ghastly procession all the injured persons that I had helped to tend on that memorable afternoon, and involuntarily I ejaculated: "Good God! when will it stop?"

The wooden houses of Jamaica are easily shaken by the movement of luggage or furniture, or even by a heavy footstep; but curiously enough one never had the slightest doubt as to the cause of a vibration. As I lay awake in bed after one of the numerous slight shocks, I pondered much, seeking an explanation of this curious fact, and believe that I found one. The vibration caused, for instance, by dropping a heavy weight on the floor of a room above, or by the banging of a door, is of a *diminuendo* character, whereas that of an earthquake is either *sostenuto* or actually *crescendo*. Now, the human nervous system has much experience of vibrations of the first description, so that none but exceptionally nervous individuals are put out by them; but, on the other hand, our organism is not sufficiently familiar with vibrations of the second class to regard them with equanimity. I was confirmed in the truth of this theory many months afterwards when seeing a lady off for the Continent. Before the Victoria Station was rebuilt I fancy that the wooden platforms had got somewhat rickety, and as I was standing by the carriage door, the platform began to shake so violently that I seriously considered which was the safest place to stand in, but before moving I realized that a porter was rapidly pushing *towards* me a truck piled up with heavy baggage. The vibration was *crescendo*, and my diaphragmatic region was correspondingly uncomfortable.

The earthquake emphasized in a remarkable manner the distinction between the Black and White races. In the case of the Blacks terror seemed to be unreasoning and unrestrained; they gave way to their emotions and yielded to a *sauve qui peut*. Of course a few Whites were little better, but they were quite the exception, and as a rule White men turned at once to help, their idea being to *do* something. It would scarcely be fair to say that the Blacks were more selfish than the Whites, still less that they were deficient in kindness; it seemed to me rather that the difference was like that between children and grown men. Nothing could have exceeded

the courage, the thoughtfulness, and the devotion to duty of the Rev. S. R. Brathwaite (a Wesleyan minister), a fine specimen of a full-blooded negro; he was as cool, as quiet, and as resourceful as any European, devoting himself to encouraging the timid, comforting the afflicted, and aiding the injured. Another notable fact was the excellent behaviour of the men of the West Indian Regiment, who showed the good effect of discipline, alike in the terrible scenes of the fire in the camp (when a score of officers and men were burnt), and in the trying picket duty in the city afterwards.

It is quite likely that a contributory cause of the panic was the fact that the Seventh Day Adventists had quite recently held a mission in Jamaica, preaching their favourite doctrine of the speedy coming of the end of the world. Naturally enough, emotional negroes who had heard their teaching would take the earthquake to be the fulfilment of their prophecies.

The negro is a cheery, good-natured fellow, who takes life very easily. His ideal occupation is said to be to lie on his back under his own coco-nut tree, chewing a piece of "cane" from his own estate, and meditating upon the hardness of the Christian religion in forbidding a man to have more than one wife, seeing that one woman can do so little work.

Admitting the negro to be indolent and unenterprising and vain withal, he is at the same time intensely religious. Nowhere have I seen such universal church-going, nowhere have I heard such congregational singing. It must, however, be admitted that the negro's religion does not have as much effect upon his morals as it should; moreover, it is reported that he is, as a consequence of his highly emotional disposition, easily wrought upon by Revivalists.

The powerfully made African is largely displaced by the slim coolie from India. The coolie, though relatively weak and unquestionably slow, can be trusted to go on working, and so gets through more in a day. It takes a constant stimulus to make the negro work, and this is entirely lacking under the easy conditions of his life. An experienced official told me that he was convinced that to double his taxation would be an act of kindness! The required stimulus is given by the sea. Accordingly we find the negro boatmen of Bermuda are famous; an officer of the Royal Mail Steam Packet Company spoke to me in the highest terms of the way in which the boating connected with their coasting work is carried out. I have said above what a grand sight it is to see the Herculean boatmen of Barbados bending to the big sweeps as they urge the heavy coal lighters against the ceaseless "Trade." But in the last-named island over-population

gives the needed stimulus, and sends some of the best labourers to the Panama Canal.

When the negro women are seen on the high road going to Kingston market with piles of produce upon their heads, one almost forgets their coarse features in their proud carriage as they swing along with their stalwart limbs. When clad in white, or better still in red or yellow, one feels that there is much to be said for a black skin, but blue (of which they are fond) is not becoming to their peculiar style of beauty, making them look *pale*.

I met a centenarian black, who seemed proud of having been a slave, and did not remember anything to complain of in his former life. When Queen Victoria died the negroes got the idea into their heads that Edward VII. would re-enslave them. I asked the lady who told me this, whether they anticipated cruelties, etc., but she said, "Oh dear, no! They seemed to fear the *indignity* of the condition; at any rate, that is what they complained of."

And now, after these long digressions, some account must be given of my entomological experiences.[1]

The Island of JAMAICA is 144 miles long by 49 miles wide, and comprises an area of 4207 square miles, so that it is about equal in size to the counties of Devon and Somerset taken together. It lies well within the tropics, being between the latitudes 17° 45′ and 18° 35′ N.

Rather more than half the total area of the island is below the 1000 ft. contour line, but some 60 square miles have an altitude of 4000 ft. and upwards, the Blue Mountain Peak attaining 7360 ft.

My most remote points were separated by 120 miles of longitude, and 40 miles of latitude, but though three weeks were spent at an elevation of 2000 ft. and upwards my highest point was but 2900 ft.

As regards geological formations, I collected upon almost all those of which the island is made up, with one important exception—I did not explore the Blue Mountains, indeed there seemed to be little inducement to do so at that time of the year.

My remarks naturally enough apply to the places visited, and to the times of my visits, limitations which should not be forgotten. My collecting was confined to ten weeks (December 31 to March 8) of the dry season, the tropical winter. However, the general aspect of the country towards the end of the dry season does not suggest to

[1] The form of the account which follows differs from the earlier part of the work, and appears (so far as Butterflies are concerned) nearly as it was first published in the *Transactions of the Entomological Society of London*, 1908, pp. 97–51.

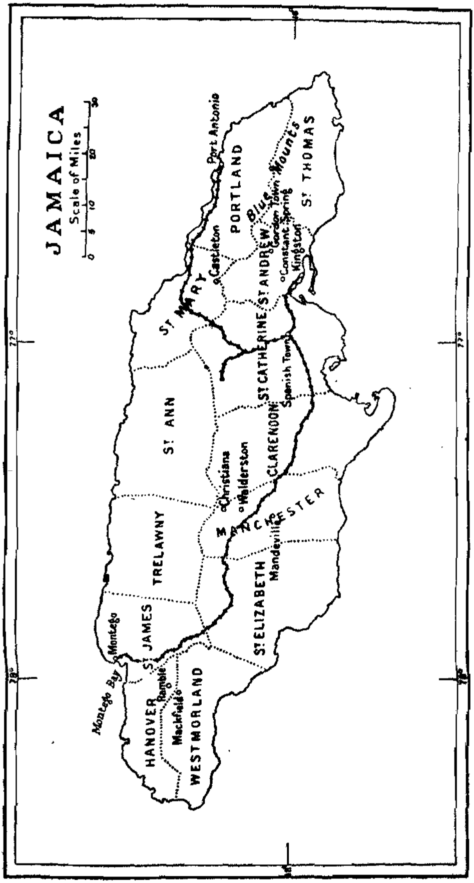

JAMAICA
Scale of Miles
0 5 10 20 30
Port Antonio
PORTLAND
ST THOMAS
Blue Mounts
Gordon Town
Constant Spring
Kingston
Castleton
ST ANDREW
ST MARY
ST CATHERINE
Spanish Town
ST ANN
CLARENDON
Christiana
Walderston
MANCHESTER
Mandeville
TRELAWNY
ST ELIZABETH
ST JAMES
Montego
Montego Bay
Ramble
Mackfield
HANOVER
WESTMORLAND

Fig. 9.

the English visitor either winter or early spring, but rather a fine, hot, late autumn, with burnt-up, gone-to-seed herbage, and falling leaves. The quiet and solitude of the woods was surprising, so that the falling of a big leaf, such as are common in the tropics, would make clatter enough upon the path to give one a start. Often where trees and varied undergrowth little disturbed by cultivation suggested a profusion of insects, scarcely any were found. Not only were butterflies scarce, but beetles, bees, wasps, and especially flies. There is a note in my diary for February 16th: "Christiana. Caught a wasp, the first seen since Constant Spring" (January 14). During that month I took but some half a dozen flies. Mr. P. H. Gosse, in his altogether admirable "Naturalist's Sojourn in Jamaica," expresses his surprise at the scarcity of insects, in words that merit quotation. "I had left England with high expectations of the richness of the West Indian entomology: large and gaily-coloured beetles, I supposed, would be crawling on almost every shrub, gorgeous butterflies be filling the air, moths be swarming about the forest-edges at night, and caterpillars be beaten from every bush. These expectations were far from being realized: . . . in general butterflies are to be obtained only casually. Moths are still more rare . . . in general beetles and the other orders are extremely scarce, and especially Diptera: I have often been astonished at the paucity of these, as compared with their abundance in Canada and the Southern United States. . . . One may often walk a mile,—I do not mean in the depth of the forest, but in situations comparatively open, beneath an unclouded sun,—and not see more than a dozen *specimens* of all orders" (pp. 94, 95).

Between sixty and seventy species of butterflies[1] occur in Jamaica, and it is a surprising fact that such a large tropical island should not produce more species than Great Britain. During my ten weeks' collecting I obtained forty-seven species, as compared with thirty-six species that are to be found in the one Devonshire parish of Mortehoe. Indeed for the most part I found Jamaica poorer in butterflies than Mortehoe in the summer. There were but two occasions on which the numbers were comparable.

On the afternoon of February 25th I was ferried over from Port Antonio to Navy Island. The Trade-wind was blowing rather strongly, and the only sheltered spot was some swampy ground to the leeward of a bluff; here *Anartia jatrophae* was in the greatest profusion, many being busy about the flowers of the Logwood-trees

[1] The negroes always call butterflies "bats," a term that for some time greatly

(*Haematoxylon campeachianum*, Linn.), with them were a few *Dione vanillae*, and one *Precis lavinia*.

The other time was on March 3rd, near the top of Shotover, to the west of Port Antonio. Here, about 1000 ft. above sea-level, on a spur of a somewhat higher hill, commanding a glorious view of sea and coast, was a steep slope with an aspect a little south of east. An acre or two of this slope, partly sheltered by trees, displayed a greater wealth of flowers than I saw anywhere else in Jamaica, the dominant and most attractive being a species of Vervain (probably *Stachytarpheta jamaicensis*, U.). It was a very hot day, with less wind than usual, and I was there from 11.15 a.m. to 12.30 noon. The beautiful, but ill-smelling Fritillary, *Dione vanillae*, was fairly swarming, while *Euptoieta hegesia* was scarcely less abundant, and among them were numerous *Precis lavinia*, and a few Skippers, *Prenes nyctelius*, *P. ares*, and *Morys valerius*. The Brimstone, *Callidryas eubule*, was coursing about in all directions, often stopping to take a sip from the Vervain, but not a single White was seen. *Colaenis* was conspicuous by its absence, while *Anartia jatrophae*, if present, did not obtrude itself on my notice. A hasty glimpse of a *Papilio* was obtained, also of a butterfly (? *Actinote* sp.), that suggested my South African acquaintance, *Planema esebria*, Hew. Among the butterflies were a few of the beautiful Arctiid, *Utetheisa bella* (*speciosa*). Altogether it was such a sight as seldom gladdens the eye, but which happily lingers long in the memory.

A few words on the localities visited:—

Constant Spring (Dec. 31—Jan. 14); the hotel stands near the northern edge of the Liguanean plain, about 500 ft. above the sea. There is good collecting in the woods at the foot of the mountains up to Stoney Hill, say 1000 ft.

Gordon Town (Jan. 9); the bed of the Hope River below the town, which I visited once, is about 800 ft.

Chancery Hall (Jan. 8, also March 7), on the plain, is beside the dry bed of a stream, to the west of Constant Spring.

Temple Hall (Jan. 11, 12), *circa* 850 ft., is on the road to Castleton, Jamaica.

All these places are in St. Andrew Parish. Parishes in Jamaica take somewhat the place of counties in England, and as the names are in constant use it seems well to give them.

Castleton, St. Mary Parish (Jan. 11, 12), is just beyond the height of land; the Botanic Garden is 500 ft. above the sea. It proved a disappointing locality.

Mandeville, Manchester Parish (Jan. 16—22), ranges from 2000 ft. to about 2200 ft. It proved very poor in insect life.

Mackfield and Ramble, close together, the former in Westmorland, the latter in Hanover (Jan. 24—Feb. 2). A delightful rolling country of pasture intermixed with woods. About 800–1000 ft. Unfortunately the very headquarters of the collector's greatest foe in Jamaica—that tiny horror, the Tick.

Montego Bay, St. James (Feb. 2—5): the collecting ground ranges from the sandy shore to the top of a wooded hill of about 300 ft., and was fairly productive.

Walderston, Manchester (Feb. 6—20); the collecting ground ranged from about 2500 ft. to 2900 ft. (Mile Gully Mountain). An almost waterless district, but the tops of the hills are covered with woods. One day (Feb. 16) was spent at Christiana in a gorge cut through Trappean Conglomerate, about seven miles to the north of Walderston. Height about 2000 ft. in a well-watered country.

Spanish Town, St. Catherine (Feb. 20—23); near the edge of an extensive plain, its elevation above the sea must be inconsiderable.

Port Antonio, Portland (Feb. 24—March 5); from the coast my collecting ground extended to the summits of Park Mount on the east and Shotover on the west, both about 1000 ft. One wonders what son of Oxford gave the green hill its honoured name.

Speaking generally, insects were commonest near the sea and on the slopes of the hills up to 1000 ft. Flies, bees, and wasps were especially scarce at 2000 ft. and over.

JAMAICAN BUTTERFLIES.

DANAINAE.—*Danaida archippus*, Fabr., 4 ♂. Only seen at Port Antonio. Found about *Asclepias*, also at Rose and other flowers; it is hard to kill. The Jamaican specimens of this butterfly differ from those from South America in the following particulars. They are brighter; they have less black along the veins; there is more fulvous at the tip of the fore-wing; the white spots beyond the cell are outlined and sometimes suffused with fulvous.

Danaida (*Tasitia*) *jamaicensis*, Bates. 2 ♀ near the stream which the Kingston-Castleton road crosses close by Temple Hall; a ♂ near Ramble Post Office, another ♂ near Walderston. Like the preceding, this is hard to kill. The form met with on the mainland, *D. eresimus*, Cram., which appears to be distinct, has much more black about it, *e.g.* along the costa and the veins.

SATYRINAE.—*Calisto zangis*, Fabr. 26 specimens. Very generally

distributed in woods, but seldom abundant. Constant Spring, Castleton, Mandeville, Mackfield (common), Walderston (common), Port Antonio (abundant). The sexes about equally divided. It flies amongst herbage so close to the ground as to be difficult to catch, yet seldom moves many yards. It is distinctly a shade-lover. On 27th February, 1907, near Port Antonio, I saw it flying freely on a rainy day.

HELICONIINAE.—*Heliconius charithonius*, Linn. 21 specimens. Generally distributed throughout the island and not uncommon. Constant Spring, Castleton (common), Mackfield, Walderston, Christiana, Montego Bay, Port Antonio (common). This butterfly has usually a slow flapping flight, often in half-shade. It is distinctly local, in the sense that it is confined to a very small area in each locality; sometimes it may be seen flying up and down a very short beat. It settles on leaves or flowers with wings fully expanded. Mr. P. W. Jarvis, of the Colonial Bank, told me that the butterfly was very common later in the year, and that it "clustered" on going to rest for the night, a number of specimens sitting close together, but not actually clinging to one another. On 5th March, 1905, at Shotover, near Port Antonio, close upon 1000 ft. above the sea, at about noon on a dull day, eight or ten were seen flying about under the shelter of a hedge. As many as seven of these settled on dead sticks, etc., within a space of 2 feet by 1 foot.[1] This butterfly is somewhat hard to kill. As compared with Venezuelan specimens, those from Jamaica have all the yellow marks a little larger; and the red spot near the base of the cell of the hind-wing is smaller, or even absent.

NYMPHALINAE.—*Colaenis cillene*, Cram. (should not the name be *cyllene*?), 12 ♂, 4 ♀. Generally distributed and not uncommon. Constant Spring (common), Castleton (common), Mackfield, Montego Bay, Walderston, Port Antonio. A grand insect on the wing, sailing about like a piece of rich gold. The imperfect condition of many of the specimens is not apparent during its strong flight. It is most easily taken at flowers such as *Lantana camara* and *Eupatorium odoratum*. One of my specimens appears to have been bitten by a lizard. The male is distinguished from that of the South American *C. delila*, Fabr., by its more orange tint and the comparative absence of black; but *cillene* is perhaps only a local race of *delila*.

Dione vanillae, Linn. 16 ♂, 7 ♀. Generally distributed and in some places very abundant. Constant Spring (common), shore of Port Royal harbour, Mandeville (abundant), Ramble (abundant),

[1] Compare Miss M. E. Fountaine's note in *Entomologist*, vol. xliv., pp. 403, 404 (1911).

Montego Bay, Walderston, Spanish Town, Port Antonio (swarming on Shotover). A brilliant insect appearing very red upon the wing, and reminding me of an *Acraea*. Although it could fly about wildly enough, several males were seen one afternoon fluttering among dead leaves close to the ground. I do not detect any difference between Jamaican and South American specimens, save that the former are usually smaller and often brighter.

Euptoieta hegesia, Cram. 12 specimens. Widely distributed but in most places scarce. Constant Spring, Temple Hall, Montego Bay (common near the hotel, also found on the sandy shore), Walderston, Port Antonio (common in a swampy meadow near the shore to the east, but in swarms on the top of Shotover). Jamaican specimens have the orbicular and reniform stigmata less clearly outlined than those from the Spanish Main; moreover the ground-colour is a brighter tawny. This insect reminded me of *Atella phalantha*, Drury.

Phyciodes frisia, Poey. 5 specimens. This little butterfly was confined to the Liguanean plain and the hills bounding it on the north, and was not common. Constant Spring, Stoney Hill, near Gordon Town, Spanish Town.

Precis lavinia, Cram. 8 specimens, all males. Constant Spring, Chancery Hall, Mandeville, Port Antonio. It usually settles on or near the ground, frequenting hot, dry, exposed places. Is wary and not easy to catch.

The nomenclature of this very variable and wide-ranging species (from the Southern United States to the Argentine) has long been in great confusion, but has been cleared up by Mr. G. A. K. Marshall, who has recently re-arranged the genus in the National Collection. Cramer named three forms, all from Surinam, *lavinia*, *evarete*, and *genoveva*. It appears to me that Mr. Marshall is quite correct in uniting these under the first name, together with the Northern form *coenia*, Hübn. (the name adopted by Messrs. Godman and Salvin in the "Biologia Centrali-Americana").

Jamaican specimens, usually known by local collectors as *Junonia genoveva*, Cram., are, as a rule, brighter than those from South America, with the transverse white band near the tip of the fore-wing fairly conspicuous, being of the form *zonalis*, Feld.[1] They are somewhat intermediate in character, between the South American and North American forms, to the latter of which specimens in the Hope Collection from the Bahamas approach more nearly.

[1] H. Fruhstorfer (*Stett. Ent. Zeit.*, 1907, p. 224) comes to the same conclusion as Marshall as to Cramer's three forms, but makes the Cuban form (*zonalis* according to Marshall) a new sub-species *michaelisi*.

Anartia jatrophae, Linn., var. *jamaicensis*, Möschl. 8 ♂, 7 ♀. Widely distributed and abundant. Constant Spring, Castleton, Mandeville, Mackfield, Montego Bay, Walderston (scarce), Christiana, Port Antonio. This, which is *par excellence* the common road-side butterfly of Jamaica, constantly reminded me of the Indian *Precis atlites*. A somewhat ghostly looking insect on the wing; when settled among whitish dead grass, with wings closed, it is very cryptic. It usually settles on the ground or close to it and does not frequent flowers much. Jamaican specimens are all very readily distinguished from those from South America by the broad bright *fulvous, or orange brown, margin to the wings. There is a mere trace of this colour in specimens from the mainland, which moreover* appear to be less densely scaled.

Cystineura dorcas, Fabr. (*mardania*, Cram.). 22 specimens. Local. Constant Spring, Gordon Town, Mackfield (abundant), Williamsfield Cave, Montego Bay, Port Antonio (common).

This delicate and very distinct butterfly, which somewhat resembles a Satyr, frequents moist, shady places with long grass. There is sometimes much fluttering in its very slow flight, but at other times it glides. Though not such a flower-lover as many Nymphalines, it often visits the Spanish Needle, *Bidens leucanthus*, W. It usually settles with its wings wide open, and if it close them up re-opens them quickly. On February 1st, 1907, near Chichester Rectory, Ramble, two were beaten out after sundown; both settled almost at once, one on the top of a grass stem with its wings up, the other towards the top of a long green fern. The second very deliberately set up its wings, then after an interval it retracted its forewings so as to conceal the large white patch. I failed to find any naturally at rest. It may be noted that *C. cana*, Erichs., the representative of *C. dorcas* on the mainland, lacks the conspicuous orange brown of the latter species.

Victorina stelenes, Linn. (So spelled by Linné; Mr. Kirby has it *steneles*; probably Linné meant to call it after either Sthenelus or Sthenele: the other names are meaningless.) 11 specimens. Widely distributed, but not common. Constant Spring, Mackfield, Walderston, Christiana, Spanish Town, Port Antonio. On the banks of the Rio Grande, on March 2nd, I saw four or five flying together about a bush of what I took to be the Rose Apple (*Jambosa vulgaris*, D.C. = *Eugenia jambos*, Linn.).

Cabinet specimens give little idea of the beauty of this butterfly during life, since its lovely green fades rapidly. Bold, like many of its family, it will return again and again to the same perch, often

a dark-green leaf at or above the level of the eye. Sitting there with its wings three-quarters open it is a truly beautiful object, yet not nearly so conspicuous as might be thought, and this is true whether its wings be open or closed, whether at rest or in its rather slow flight. One courageous specimen settled first at my feet and then upon my net. In Jamaican specimens the fulvous spot at the anal angle of the hind-wing is larger and brighter than in South American; there is also somewhat more fulvous on the underside, the bands being broader.

Aganisthos orion, Fabr. (*odius*, Fabr.). 5 specimens. This very fine and robust Butterfly was only met with to the west of Port Antonio near the sea-level.[1] A strong flier frequenting the tops of trees, especially the Star Apple, *Chrysophyllum cainito*, Linn., on the leaves and fruit of which it occasionally settles. More frequently it is seen to rest on tree-trunks (in particular the Logwood), on posts or buildings within a few feet of the ground, always with its head downwards and wings closed over its back. When thus settled it may be detected, if seen in profile, at a considerable distance in spite of its cryptic coloration. It is not easy to catch even when settled, and I spent much time over it. One of my specimens seems to show a bird-bite at the usual corner of the hind-wings. In the Jamaican specimens the fulvous band across the fore-wing is much broader than in those from the mainland; there is also a tendency for the fulvous on the hind-wing to be more extended. It is quite probable that sundry large brown butterflies seen at Ramble and Walderston may have belonged to this species or the next. At the suggestion of the late Col. Bingham, I tried to attract this butterfly by over-ripe bananas, scenting some with alcohol, others with ammonia. I strolled off a short distance, returning from time to time, to find indeed no butterflies, but on each occasion fewer and fewer fragments of the fruit. On the last visit I found—an ass eating with much gusto the last piece.

Coea acheronta, Fabr. (*cadmus*, Cram.). A broken fore-wing of this species was picked up off the ground in a wood above Constant Spring, January 5th, 1907. The Haïti specimens in the Hope Collection are more fulvous than those from the mainland, and this fragment appears to be of Haïtian type.

LYCAENIDAE.—*Leptotes* (*Tarucus*) *theonus*, Lefebvre, 1856 (*Plebeius*

[1] Messrs. Godman and Salvin ("Butterflies of St. Vincent, Grenada, etc.," *Proc. Zool. Soc. Lond.* 1896, p. 515) say: "Grenada. Two specimens of this common species, which is also found in Hispaniola, but in no other West Indian island that we know of." It is, however, one of the few butterflies named by Gosse ("A Naturalist's Sojourn in Jamaica" (1851), p. 99).

cassius, Cram., var. a, *floridensis*, Morrison, 1874), 8 ♂, 19 ♀. Taken in every locality that I visited: common at Mackfield; abundant at Constant Spring, Gordon Town, and Port Antonio. The excess of females taken may be attributed to their superior size and attractiveness, but possibly they are easier to capture. It is most often seen flying over shrubs or near woods; it has a quick jerky flight, and, especially the female, appears larger than it is. After rain it is about the first butterfly to come out.

All my specimens taken in Jamaica are distinguishable at a glance from those taken in South America, Trinidad or Tobago. They are smaller and darker; the hind-wing of the male is violet-blue instead of white; the fore-wing of the female is shot with blue over at least two-thirds of the fore-wing, and there is much less white in the hind-wing. On the underside the metallic-centred ocellus is larger, and there are differences in the dark markings of the fore-wing.

In my opinion it is specifically distinct from *P. cassius*, Cram., but if not distinct it is a very well-marked local race. The earliest description of the form that I can find is that by Lefebvre, and it should, I think, bear his name.[1]

Catochrysops hanno, Stoll (? *monops*, Zeller). 11 specimens. Abundant at Constant Spring, also met with at Mackfield, Walderston, and Port Antonio. Its small size and insignificant appearance probably cause it to be often passed over. It frequents small Composites by the roadside, especially *Distreptus spicatus*, Cass.

Callipsyche thius, Hübn. A single very fine male near the Jam Factory at the foot of the hills, Constant Spring. On the wing I took it for a Skipper. This and the specimens from Jamaica in the National Collection lack the white mark at the tip of the fore-wing of the male seen in Venezuelan examples.

Calycopis pan, Drury. Three specimens, taken in the garden at Walderston by my Portuguese servant. The lobes of the hind-wings are everted as in the Indian *Aphnaeus* and the South African *Argiolaus*.

Pierinae.—*Callidryas eubule*, Linn. (f. *sennae*, Linn.). 17 ♂, 14 ♀. Constant Spring (common), Gordon Town (abundant), Castleton, Temple Hall (abundant), Mandeville, Mackfield (common), Montego Bay (common), Walderston, Christiana, Spanish Town (abundant), Port Antonio (abundant).

If not actually the most abundant, it is at all events the

[1] Ramon de la Sagra, "Historia fisica, etc., de la Isla de Cuba," vii., p. 611, 1857. Edited by H. Lucas. In "The Butterfly Book," 1899, p. 270, Dr. W. J. Holland calls it *Lycaena theonus*, Lucas.

most conspicuous butterfly on the island; brilliant in colour, bold in flight, and numerous in individuals, it was always much in evidence. The dry-season form prevailed, more especially as the spring advanced.

Mr. E. André[1] speaks of *Callidryas* as a great drinker. The only time when I have seen any proof of this was when going down the beautiful Rio Grande on a raft. At about 3 p.m. five yellowish butterflies, which I took to be *C. eubule*, were seen drinking close together on the bank.

Kricogonia lyside, Godart, 6 ♂, 2 ♀. Ramble, Montego Bay, Spanish Town, Port Antonio; not uncommon along the coast to the eastward.

Glutophrissa (?) *drusilla*, Cram. Common at Constant Spring, also taken at Montego Bay. This species usually flies fast and high, frequenting flowering trees and so keeping out of reach. I took a female at the flower of *Eupatorium odoratum*. My specimens are small, especially the females, which are quite devoid of black markings. Somewhat similar specimens from Jamaica and other islands were named *ilaire*, Godart, by Mr. Butler, but the type of Godart's insect came from Brazil. In the museum at Kingston this bears, or rather bore,[2] the name *Appias poeyi*, Butl. It is perhaps the *Mylothris margarita* of Hübner. It would be interesting to see Jamaican specimens taken in the wet season, for the presumption is that mine are of the "dry" form.

Sphaenogona adamsi, Lathy. Of this butterfly, so rare in collections, I was fortunate enough to secure a male and three females. One of the latter was taken near Constant Spring, the other three specimens on the Manchester Mountains, viz. one at Contrivance, about 2700 ft., the other two on Mile Gully Mountain at nearly the same elevation. The solitary specimen in the National Collection is labelled "Kingston, Jamaica."

Terias (*Eurema*) *euterpe*, Ménét., 39 ♂, 21 ♀. The commonest species of the genus in Jamaica: Constant Spring (abundant), Gordon Town (not common), Castleton, Mandeville, Ramble (abundant), Montego Bay, Walderston (not common), Port Antonio (common). As this little butterfly flits along close to the ground it looks easy to catch; however, it goes faster than one would think; its flight is jerky, and when struck at it almost always goes down into the herbage and so escapes the net again and again. This

[1] See above, p. 103.

[2] I have altered the tense from present to past, since the earthquake destroyed all the types and some others of the *Lepidoptera* in the museum.

remark must be held to apply to several species of *Terias*, for they were not always distinguished in the field.

A male was taken at Mackfield with a small symmetrical injury to each hind-wing.

Terias westwoodii, Boisd. (The Jamaican form, (?) *dina*, Poey.) Three males, two females. Only met with at Montego Bay. It flies more freely and more strongly than the last. The Jamaican specimens are small and pale: the black on the hind-margin (especially in the female) is limited to the tip of the fore-wing.

Terias messalina, Fabr., 10 ♂, 10 ♀. Constant Spring, hotel grounds and wood to N.E., Mackfield (common), Montego Bay, Spanish Town, Port Antonio. It looks larger than *euterpe* when on the wing.

Terias delia, Cram., 16 ♂, 14 ♀. Widely distributed, but not so common as *euterpe*. Constant Spring (common), Castleton, Mandeville, Mackfield, Montego Bay, Walderston, Port Antonio.

A male taken above Constant Spring at about 1000 ft. elevation on January 1st; and another male taken near Chancery Hall, 500 ft., on January 8th, approached the form *lydia*, Feld., in having the longitudinal black streak broader than usual. On the other hand, another male taken somewhat below the first-named and on the same day has no black streak at all, merely the streak of orange.

Terias elathea, Cram., 3 ♂, 1 ♀. Scarce. Constant Spring, Montego Bay, Port Antonio (Shotover Hill).

This butterfly appears to be specifically distinct from *delia*, Cram., but is certainly very closely allied to it. The females are difficult to distinguish, and some specimens of the male sex not easy. In two males from Venezuela one has the black streak obsolescent, in the other entirely absent with indeed very little orange.

Pieris (*Perrhybris*) *phileta*, Fabr. (*monuste*, Hübn. *et auct.*, *nec* Linn.), 4 ♂, 1 ♀. Only seen at Montego Bay, and at Contrivance, Walderston. The flight of this butterfly is sometimes extremely swift, and it exercised my active Portuguese servant and myself very severely to secure three specimens near the shore of Montego Bay.[1] Sometimes it may be taken at the flowers of *Eupatorium odoratum*, Linn. During life the clubs of the antennae are of a beautiful turquoise blue.

[1] Mr. P. A. Buxton found *P. phileta* in great profusion about Kingston and Mandeville, April 19th–23rd, 1909, but found it easy to catch, as its flight was then not much faster than that of *Gonoris napi* in England. He noticed the clubs of its antennae, but says that they were bright green with a tinge of blue. If I was correct in describing them as turquoise-blue they must have faded—just as the stone does. See *Reports of Rugby School Natural History Society*, 43rd, 1909, p. 40; and 44th, 1910, p. 26.

PAPILIONINAE.—*Papilio polydamas*, Linn., f. *polycrates*, Hopff. 7 specimens. Constant Spring (common), below Gordon Town, Spanish Town; not seen on the high land. Fond of flowers, especially *Bougainvillea*, fluttering as it feeds, as many of the family do. A male observed flying in deep shade about 5 p.m., settled on a dead leaf and closed its wings; the underside was distinctly cryptic.

All my specimens are of the insular form in which the marginal spots of the fore-wing are paler, those of the hind-wing greener, than in South American examples: the marginal pattern on the underside of the hind-wing is coarser, with more brick-red and more white in it.

HESPERIDAE.—*Eudamus proteus*, Linn. 9 specimens. Constant Spring, below Gordon Town, Port Antonio (common). Has a quiet

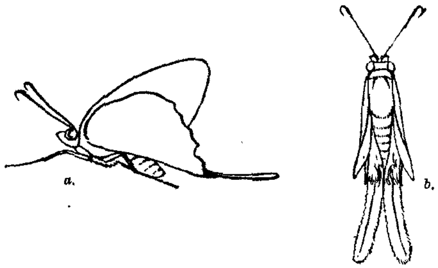


FIG. 10.—*Eudamus proteus* at rest. (*a*) Side view; (*b*) from above.

flapping flight; at rest all its wings are nearly upright, but the fore-wings much sloped back, the *tails at right angles to the plane of the hind-wings*. Frequents *Bougainvillea* flowers. (See Fig. 10.) [1]

Eudamus catillus, Cram. Two specimens, taken late in the afternoon in a wood at Montego Bay; flight not very swift. (See cover of this book.)

Thymele grenadensis, Schaus. A very worn specimen on the bank of the Rio Cobre, Spanish Town; it settled repeatedly on the same spot.

Telegonus hurga, Schaus. A worn specimen, in the Mahogany Wood, Rockalva, Ramble. It was very bold, returning again and again to rest on the same fallen tree.

Perichares corydon, Fabr. Two. Mackfield, Montego Bay.

[1] See also Chapter X., § 11, *infra*.

Prenes nyctelius, Latr. Three. Mandeville, Shotover, East Harbour, Port Antonio.

Prenes ares, Feld. One. Shotover, Port Antonio.

Anastrus simplicior, Möschl. One. Cold Harbour, Port Antonio. Rests with the wings fully expanded.

Acolastus amyntas, Linn. One, taken by Mrs. Longstaff in the Botanic Garden, Castleton.

Serdis insolita, Butl. (*aurinia*, Plötz). One of each sex taken at the foot of Park Mount, Port Antonio, about 2.30 p.m. A very distinct insect identified by Mr. H. H. Druce with Plötz's excellent figure of the male from a Jamaican specimen. Mr. Godman[1] says of the figure that it probably belongs to *Limochores* or *Serdis*. Mabille places it in his genus *Serdis* under the heading "Species non visae."[2]

Ephyriades otreus, Cram. One specimen, near Chancery Hall, Constant Spring; settled on a projecting grass stem with wings fully expanded.

Hesperia syrichthus, Fabr. Twelve. Generally distributed over the Island, especially common at Mandeville and Port Antonio. A somewhat variable species within limits. It rests with the wings fully expanded.

Hylephila phylaeus, Drury. Five. This brilliant little golden Skipper was common near the shore, Port Antonio.

Catia drurii, Latr. Two. Below Gordon Town, *circa* 800 ft., and on the Park Mount Road, Port Antonio, *circa* 600 ft. It is very hard to see. It rests with all the wings up, the fore-wings much sloped back.

Catia vesuria, Plötz. One, taken by my Portuguese servant in the garden at Walderston. There was but one specimen of this species in the National Collection and that was unnamed.

Morys valerius, Möschl. Four. Two above Constant Spring, *circa* 700 ft.; two on Shotover, Port Antonio.

Thymelicus vibex, Hübn. (The yellowest form: *T. combinata*, Plötz, *teste* H. H. Druce.) A female *came to light* at Montego Bay.

Cymaenes silius, Latr. One, in the wood above the Jam Factory, Constant Spring.

[1] *Ann. Mag. Nat. Hist.* (7), xx., p. 152 (1907).

[2] *Genera Insectorum*, Hesperidae, p. 144. On April 5th, 1908, Mr. H. H. Druce wrote saying that among some oddments in the British Museum he had come across the type of Butler's *Pamphila insolata*. The specimen is from Jamaica (labelled *insolita*), and appears to be identical with my insects. Butler's name has priority since Plötz published his description in 1883. (See *Proc. Zool. Soc. Lond.*, 1878, p. 483.)

I call especial attention to the number of species in which Jamaican examples differ from Venezuelan in the replacement of black or grey by fulvous, or orange-brown. [Compare the Arctiid moth, *Ammelo insulata*.] It is true that the soil of Jamaica, even where the formation is white coralline limestone, is often of an orange-brown colour, but it scarcely seems possible to connect the two as cause and effect. It is just such differences as these, occurring in different families, and not complicated by any possibility of mimicry, which seem to me to afford good evidence of the effect of environment,[1] although we may at present be quite unable to explain it.

Many facts as to the scents of Jamaican butterflies, and other Bionomic points will be fonnd in Chapter X.

JAMAICAN MOTHS.

I did not come across many moths by day, though a fair number visited the hotel lights at night, when it was noticed that they often sat quietly on brilliantly illuminated walls or blinds, in preference to going near the lamps themselves. Unless otherwise specially stated it may be assumed that all the moths in the following list were victims of the fatal attraction of light.

SYNTOMIDAE.—*Cosmosoma achemon*, Fabr. Two: Mackfield, Montego Bay. A common West Indian species.—*Empyreuma pugione*, Linn. One: Walderston. A very *Zygaena*-like form.

ARCTIIDAE.—*Utetheisa bella*, Linn., sub sp. *venusta*, Dalm. (*speciosa*, Walk.). Common: Constant Spring, Montego Bay, Spanish Town (at light), Port Antonio. As its several names imply this is an even more beautiful moth than the European species; it was usually seen flying by day, both in the sun and at dusk, or was kicked up from long grass, like a *Crambus*.—*Ammelo insulata*, Walk. Common: Constant Spring, Montego Bay, Walderston. Jamaican specimens are yellower than Venezuelan; *A. helops*, Cram. (*Halosidota chrysogaster*, Walk.). Two: Mandeville, Montego Bay.—*Arc marginata*, Drury. Two males and one female: Mandeville, Ramble, Mackfield.—*Automolis delicata*, Möschl. A single specimen of this very beautiful insect came to light at Constant Spring; it well deserves its name; as the British Museum possesses but three specimens, all from Jamaica, it is presumably not common.—*Ecpantheria nigriplaga*,

[1] The insects referred to are still kept together just as they were exhibited at the Darwin Celebration at the Linnean Society, and may be seen in the Hope Department of the Oxford University Museum.

Walk. A male taken at Mackfield.—*Opharus bimaculatus*, Dewitz. One at Montego Bay. The British Museum has but three specimens, all from Central America.—*Euglyphia hieroglyphica*, Cram. One at Constant Spring. [A specimen of this lovely moth was captured in the West India Docks, London, in 1867.]—*Theages strigosa*, Walk. Two: Montego Bay, Walderston. The latter specimen was taken by a new method: a black hand-maiden of the household saw it enter the huge white corolla of the *Beaumontia;* she deftly tied up the mouth of the flower, plucked it with the insect imprisoned, and brought it to me in triumph! In that climate this glorious creeper has been known to grow 18 feet in one season. More than once I saw a humming bird enter one of its capacious white tubes and *sit down* to feed, but whether on honey or on insects was not determined.

Noctuidae.—*Agrotis ypsilon*, Rott. A specimen of this cosmopolitan species came to light at Spanish Town.—*Perigea subaurea*, Guen. Common: Mandeville, Mackfield, Walderston, Spanish Town. A neatly marked species, recalling *Hydroecia nictitans*.—*Prodenia signifera*, Walk. One at Mandeville; *P. cupentia*, Cram. Two at Walderston. A pretty chocolate and grey species.—*Cirphis latiuscula*, H.-Schäff. Three: Constant Spring, Montego Bay; *C. numidicola*, Guen. Four: Mackfield, Montego Bay, Walderston.—*Cydosia histrio*, Fabr. Three: Constant Spring, Montego Bay. A spotted red and black insect with white hind-wings, which I took to be an Arctiid.—*Monodes nucicolora*, Guen. Three: Spanish Town.—*Poaphila immunis*, Guen. Four: Constant Spring, Montego Bay. A common West Indian species.—*Remigia repanda*, Fabr. Abundant: Constant Spring, Mandeville, Montego Bay, Walderston. A variable insect, some specimens coming very near to the Oriental *R. archesia*, Cram.; *R. megas*, Guen. One at Walderston.—*Erebus odorus*, Fabr. One specimen of this large, broad-winged moth came to light at Constant Spring; another was either disturbed, or flew by day of its own accord at Spanish Town.—*Homoptera lunata*, Drury. Two: Mandeville, Montego Bay.—*Melipotis bistriga*, Walk. One at Montego Bay; *M. manipularis*, Guen. Two at Spanish Town; *M. parens*, Walk. Two at Spanish Town; not a common species.—*Elousa albicans*, Walk. One at Spanish Town; a small grey and white insect.

Deltoidae.—*Ethnistis munitalis*, Ledr. Three: Constant Spring, Mandeville.

Hypsidae.—*Lauron ergolis*, Walk. One at Constant Spring; a good mimic of *Ithomia*.

Dalceridae.—*Acraga ciliata*, Walk. A male at Constant

Spring. This species is represented in the British Museum by Walker's type only, a female.[1]

COSSIDAE.—*Duomitus jamaicensis*, Schaus. Two at Constant Spring. This may be described as a Leopard-moth with the wing-pattern of a Goat-moth.

SPHINGIDAE.—*Theretra nechus*, Cram. Two: Mandeville, Walderston.—*Ancyryx alope*, Druce. One at Montego Bay.—*Calliomma pluto*, Fabr. One at Montego Bay.—*Cocytius* (?) *medon*, Stoll (? *duponchelii*, Poey). One at the flowers of *Beaumontia*, Walderston.—*Pachylia ficus*, Linn. One at Spanish Town.

URANIIDAE.—*Sematura aegistus*, Fabr. Six: Mandeville, Walderston. One taken on the wing just before dusk, the others at light.

The clever drawing made by Mr. H. Knight (from my sketch and specially set specimens) illustrates the very peculiar attitude adopted by this common Jamaican moth. The hind-wings are somewhat fluted, as in *Pararge aegeria*, the anal angle of the hind-wings is *inverted*, not everted as in the Lycaenids. A procryptic resemblance to a dead leaf might be naturally suggested as a possible explanation,

FIG. 11.—*Sematura aegistus* at rest, viewed from behind.

but the only specimens that I have seen at rest were inside houses whither they had been attracted by light.

GEOMETRIDAE.—*Ourapteryx flavifimbria*, Walk. A white moth, of which I took one specimen at Mackfield.—*Orthogramma coppryi*, Guen. One at Constant Spring; it somewhat resembles *Ennomos fuscantaria*.—*Sabulodes subopalaria*, Walk. One at Mandeville.—*Nepheloleuca politia*, Cram. Two: Mandeville, Montego Bay.—*Oenothalia alexonaria*, Walk. One at Walderston; the British Museum possesses two only, paler than mine.—*Biston arnabia*, Cram. A male at Spanish Town: a whitish-grey moth.—*Oxydia vesulia*, Cram. Three: Mandeville, Walderston; a variable species.—*Hyria rubripictata*, Hmpsn. A single specimen of this very pretty little purple and gold moth came to light at Walderston.—*Racheospila* (?) *undulosa*, Kaye (? *rufilineata*, Warr.). Two worn specimens at Constant Spring; *R. sigillaria*, Guen. (*congruata*, Walk.) One at

[1] The *Dalceridae* are a small group near the *Lasiocampidae*, but resembling the *Lymantriidae*.

Montego Bay. This is a small Emerald with pink margins to the wings.—*Tachyphyle* (*Dichorda*) *iris*, Butl. Two at Montego Bay; a small bright green Emerald.—*Anisodes ordinata*, Walk. One at Mandeville [like *Ephyra pendularia*, but larger]; *A. conspicillaria*, Snell. One at Mandeville, a little thing; *A. coxaria*, Guen. One at Mackfield.—*Bapta tributaria*, Walk., f. *argentea*, Warr. (type from Jamaica). One worn specimen of this glistening white moth came to light at Walderston.—*Hammaptera tenera*, Warr. Six at Montego Bay.—*Craspedia compensata*, Walk. One at Constant Spring.—*Triphosa stellata*, Guen. Two: Constant Spring, Montego Bay. [Like a small *Scotosia*.]—*Pterocypha defensata*, Walk. Four: Montego Bay, Spanish Town; an extremely variable Larentiid.—*Drepanodes* sp. A moth came to light, at Montego Bay, which may be a dark form of *D. falcularia*, Sepp., otherwise it is not represented in the British Museum. Mr. L. B. Prout thinks it is probably a new species.

PYRALIDAE.—*Pyrausta insignitalis*, Guen. A single specimen was taken in the wood behind "The Retreat," Constant Spring, flying very low down among the herbage; it looks golden-yellow on the wing; *P. meninalis*, Hübn. One at Constant Spring; *P. cardinalalis*, Guen. A tiny scarlet and black moth; one was taken flying in the sun at Castleton; another came to light at Constant Spring; it is curious that these sun-loving Pyrales are often taken at light; *P. agathalis*, Walk. One at Mackfield. This is another little Purple and Gold, that one would have expected to take in sunshine rather than at the electric light; *P. signatalis*, Walk. One at Montego Bay.—*Zinckenia perspectalis*, Hübn. One at Walderston. This would appear to be a common species, it is black.—*Nacoleia indicata*, Fabr. Three: Constant Spring, Castleton, Mackfield; *N. annulalis*, Hübn. One at Montego Bay.—*Argyractis jalapalis*, Schaus. Two at Constant Spring; a China-mark.—*Crocidophora huronalis*, Guen. Two: Constant Spring, Walderston; a golden-brown moth with neat laced pattern.—*Desmia tages*, Cram. One at Mandeville.—*Salobrena rubiginea*, Hmpsn. Seven: Mandeville, Walderston, Constant Spring; a very distinct looking thing, brick-red with truncate fore-wings.—*Syngamia florella*, Cram. Four specimens of this purple, gold-spotted moth came to light at Mandeville, but it was also met with by day at Christiana and the Bog Walk, Spanish Town; *S. tytiusalis*, Walk. One at Mackfield; a tiny light grey creature.—*Samia ecclesialis*, Guen. Four: Mandeville, Walderston. A moth with lace-like pattern.—*Pachyzancla phoeopteralis*, Guen. One at Montego Bay, at light; one at Port Antonio, by day. This is a dingy, widely distributed species.—*Glyphodes incidalis*, Hübn. Two:

Mandeville, Montego Bay; *G. hyalinata*, Linn. One at Montego Bay; a pearly dark-bordered moth; *G. aurocostalis*, Guen. Three: Montego Bay, Spanish Town; white with fawn-coloured costa.—*Leucinodes orbonalis*, Guen. Three at Contant Spring.—*Nomophila noctuella*, Schiff. Two: Constant Spring, Castleton. This is one of the most generally distributed of moths.—*Platytes opposita*, Zell. Common: Constant Spring, Mackfield; a tiny silver-white Crambid.

TINEIDAE.—*Autoceras mixta*, Möschl. Four: Castleton, Montego Bay, Walderston; a Hyponomeutid.

For the entomologist who, in consequence of age, infirmity, fatigue, or mere lack of enterprise, does not venture into the wilds by night, the lamp is an excellent means of collecting, and one by which some insight may be obtained into the moth fauna of a locality of which the traveller might otherwise have no idea. It has, however, two grave disadvantages: (1) a great number of odd specimens are obtained, and (2) it gives no information as to the place of abode, or mode of life of the insects captured.[1] Boxing moths off lamps is much like cutting stamps off envelopes, it does not tell you anything about the countries from which they come. "Light" is admirable from the point of view of the systematists and of the "mere collector," but not very profitable to the naturalist.

JAMAICAN BEETLES.

I did not spend much time in looking for Beetles, and what little work I did in that way was disappointing. As a group the Lamellicorns were the most obvious. Rotten wood produced fair numbers of *Scalmus* (*Ninus*) *interstitialis*, Esch., a large beetle which I found at Constant Spring, Mackfield, and Port Antonio. When handled, especially when first handled, they emitted a creaking sound, caused by an evident up-and-down movement of the abdomen, but whether or no this rubs against the elytra, I was not able to satisfy myself. The rufous colour of young individuals presents a fine contrast to the black of adults. At Stoney Hill, near Constant Spring, a dead specimen of *Macraspis tetradactyla*, Linn., was found in a rotten log; my servant took another at Walderston flying in the garden. A *Gymnetis lanius*, Linn., locally known as the "News-bug"—being the supposed bringer of news—was found in a house at Walderston; it is a creature with very hard integuments. *Ligyrus tumulosus*, Burm.,

[1] Mr. F. R. D. Onslow says that light attracts far more males than females.

ventured even on to the Governor's dining-table in the King's House, but that was after the earthquake had shaken all institutions to their very foundations. The Scarab, *Phanaeus sulcatus*, Drury (*belzebul*, Fabr.), Mandeville, Walderston, was abundant flying about dung at dusk, it also came to light and one was "found drowned." The small Chafer, *Cyclocephala signata*, Drury, came freely to light at Constant Spring and Spanish Town. These beetles are locally known as "Hard-backs," though they are in reality somewhat soft, as beetles go. *Democrates croesus*, Newm. Four came to light at Walderston, and one was found in a hole in the earth under a stone. Of *Lachnosterna* sp. a specimen came to light at Spanish Town; the British Museum possesses a single, unnamed, specimen from Jamaica.

The Longicorns were somewhat insignificant; *Achryson surinamum*, Linn., turned up in our bedroom at Constant Spring. *Lagochirus ananeformis*, Linn., came to light at Montego Bay. *Chlorida festiva*, Linn., came to light at Port Antonio. *Elaphidion spinicorne*, Drury, did the same at Constant Spring.

At Mackfield on February 1st my servant brought me a specimen of the Elaterid Fire-fly, *Pyrophorus noctilucus*, Linn., which exhibited a pair of constant green lights from points near either angle of the prothorax. It "clicked" violently when held in the fingers, but I failed to make it display a red light as described by Gosse.[1] When the green lights were dying out they seemed to pulsate. Unfortunately I had no further opportunity of observing this interesting insect, but the smaller Fire-fly, *Photuris jamaicensis*, Ernst Oliv., was a frequent visitor to the hotel lights at Constant Spring, Mandeville, Walderston, and especially Castleton. This Firefly, which belongs to quite a different group, the Malacodermata, exhibited on irritation an intermittent bright green light on the under-side of the last two segments of the abdomen. The scintillations appeared to be about 20 to 25 per minute. Four of the beetles were put into the cyanide-bottle with the result that their lights at once became *continuous* and remained so; the insects themselves appeared to become insensible almost immediately. After the expiration of 15 minutes the light of two of the insects was rather faint; after 25 minutes one was very nearly extinct; after 35 minutes all the lights were faint, one was scarcely visible; after 50 minutes three of the insects were still distinctly, though faintly, luminous; at 64 minutes three of the lights were nearly out, the fourth was faint. Bed-time terminated the experiment. Another beetle of the same species

[1] "A Naturalist's Sojourn in Jamaica," p. 102 (1851).

experimented upon five weeks later was still faintly luminous after being 75 minutes in the cyanide-bottle.[1]

The Lycid *Thonalmus militaris*, Dalm., was taken by day on the wing at Mandeville and Walderston. Lady-birds were fairly numerous, by far the commonest being *Neda sanguinea*, Linn., which I met with at almost every place I visited, it was taken by sweeping, at rest on various plants, etc. *Brachyacantha erythrocephala*, Fabr., occurred somewhat commonly at Walderston, Christiana, and to the east of Port Antonio. Of *Hyperaspis connectens*, Thunb., I took a single example at Christiana. At Port Antonio, close by the sea, I captured a single specimen of another Lady-bird which is not represented at South Kensington.

Of the *Hydrophilidae* I took at Walderston under bark of rotten wood two specimens of a *Cyclonotum*, and Mrs. Longstaff found another in a snail shell at Mackfield. At Spanish Town among dead leaves near the Rio Cobre I obtained four specimens of another species of the same genus. In company with them were two of a Histerid of the genus *Epierus*.

Other miscellaneous beetles were a *Diabrotica* which came to light at Walderston; the British Museum has the species, but it is nameless. Of *Haltica jamaicensis*, Fabr., two turned up at Christiana sitting on a plant which looked very like Willow Herb, *Epilobium hirsutum*, Linn. Sweeping at Port Antonio yielded three *Ceratoma ruficornis*, Oliv. At the top of Park Mount, Port Antonio, *circa* 1000 ft., three specimens of a distinct, prettily marked Weevil, a *Cholus* of a species not in the British Museum, were taken; two of them were obtained by sweeping, the third was found on the underside of a stem, apparently seeking shelter from the rain. Of another Weevil, a glaucous green insect, which Mr. Gahan assured me was not represented in the National Collection, one was taken at Constant Spring on a leaf of a species of (?) *Acacia*, where it was strangely conspicuous; two others were found by Miss Walders on *Tropaeolum* in her garden at Walderston. A fungus (? *Polyporus*) on a log by the Rio Cobre at Spanish Town was full of a species of *Arrhenoplitis*, of which there are unnamed Jamaican representatives at South Kensington.

JAMAICAN BUGS.

The Pentatomid *Loxa flavicollis*, Drury, a large green fetid beast, with a long spine on each shoulder, came to light at Constant Spring

[1] Compare pp. 327, 333, *infra*. For Fire-flies of Ceylon, see below, pp. 378, 379.

and Montego Bay. *Nezara marginata*, Beauv., a smaller but also offensive insect occurred at the same localities, falling to the beating stick. The fetid brown *Piezodorus guildingi*, Westw., was swept up at Constant Spring and Ramble.

The Lygaeids were represented by the brilliant scarlet and black *Dysdercus jamaicensis*, Walk., of which two came to light at Walderston, together with the similarly coloured *D. andreae*, Linn., and *D. mimus*, Say. Of these *D. andreae* was very abundant on some cotton plants in the cemetery at Montego Bay, and *D. mimus* might be obtained in any numbers by sweeping at Constant Spring, Ramble, Walderston, or Port Antonio.

The Coreid *Jadera aeola*, Dall., came somewhat freely to light at Montego Bay and Walderston.

Other bugs were *Euchistus bigibbulus*, Beauv., a small dark brown insect with spiny shoulders, which was swept at Constant Spring, but came to light at Port Antonio; *Lycambis triangulus*, Spin., which I beat out in the cemetery at Montego Bay, is a bug with highly developed femora; a black *Phthia* with brilliant orange markings, found crawling on the ground by my servant on the slopes of Mile Gully Mountain, at an elevation of about 2400 ft.; it was unrepresented in the National Collection; a *Chariesterus*, also unrepresented at South Kensington, was swept up near the shore to the east of Port Antonio; while sweeping on Shotover yielded three of the red and black *Oncopeltus fasciatus*, Dall.

A concrete reservoir in the Castleton Gardens yielded half a dozen of a *Ranatra* allied to, if not identical with, *fusca*, Beauv.

However, my greatest triumph in the bug line occurred in this fashion:—After retiring to bed at Constant Spring I was aroused by a knocking at the door and a man's voice calling to me eagerly to bring my net as he had a very big bug. As the entomological language of the "Pearl of the Antilles" takes a strong colour from the Great Republic, I expected to find a Sphinx or a big Noctuid, and sallied forth in my pyjamas. It was somewhat disconcerting to find quite a party on the landing, including a lady. A gentleman held in a folded handkerchief a huge water-bug called by Americans the Electric Bug on account of its frequenting the electric lights. I was myself somewhat awed, not having seen such an animal before, it is three inches long and over an inch wide! Judging from a never-forgotten boyish experience of our little British *Naucoris cimicoides*, Linn., the American insect, *Belostoma colossicum*, Stål, might inflict a most painful wound.

JAMAICAN ACULEATES.

Two forms of Honey-bee were met with, *Apis mellifica*, f. *ligustica*, and *A. mellifica*, f. *mellifica*, the latter being somewhat the commoner. I do not appear to have come across more than two Carpenter-bees, *Xylocopa aeneipennis*, De Geer, both at the flowers of *Bougainvillea* in the garden of the Constant Spring hotel. Perhaps the commonest bee in the island was *Exomolopsis rufitarsis*, Smith, which was to be found at Constant Spring at the flowers of a blue Labiate, and was swept up at dusk; it was also obtained near Port Antonio, by sweeping. The same method of collecting at both the last-named place and Ramble frequently yielded a species of *Augochlora*, which at Port Antonio was in company with a *Halictus* and a *Ceratina*.

The only Wasp found in any numbers was *Polistes crinita*, Fell., which occurred at Spanish Town, Christiana and Port Antonio, but was abundant at Constant Spring where its pedunculated nests stood in rows in one of the bath-rooms, a somewhat fearsome sight; it was also to be seen at the flowers of *Eupatorium odoratum*, and *Polygonum* (?) *acre*, Kth. Sweeping at dusk at Constant Spring yielded several *Odynerus simplicicornis*, Sauss.; of *O. grenadensis*, Ashmd., a female was captured at Port Antonio. At Chancery Hall, not a great way from Constant Spring, I took both sexes of the Scoliid *Dielis plumipes*, Drury, on *Eupatorium odoratum*; the female is a large handsome dark-yellow and black insect, the male is smaller, more slender and paler. Sweeping at Port Antonio produced a single specimen of *Plesia* (*Elis*) *nitida*, Smith, together with an unnamed *Notogonia*.

The most obvious Ants were *Camponotus conspicuus*, Smith, and *Odontomachus* (?) *haematodes*, Linn. The former is of a yellow-red colour; its female came to light at Constant Spring, and amputated its own wings shortly after capture. A large community was found at Mackfield in a dying Banana-tree, which was in a wet pulpy condition, seemingly in consequence of the operations of some internal-feeding larva. At Walderston a number of the same ants were found in a hollow dead stick, as well as under a stone; it was also met with at Montpelier station and at Port Antonio. They were extremely active and swift in their movements, but their bite was quite trifling; on the other hand, they were protected by very hard integuments, and exhaled a strong odour of formic acid, nevertheless cocks and hens fed on them greedily. The *Odontomachus* is a much more formidable insect of a blackish colour; less active in its movements

than the other kind, it goes about with its jaws widely extended, evidently seeking whom it may devour. Its bite is severe, decidedly painful at the time though not producing any lasting effect; doubtless its more powerful armament permitted it to indulge in more leisurely movements. It was common at Mackfield, and a female came to light at Montego Bay. A nest was found in a rotten log of wood.

JAMAICAN ORTHOPTERA.

None of my Neuroptera, and very few of my Orthoptera, have as yet been named, but nevertheless the latter are not without interest. One day at Walderston when hunting among vegetable débris for Land Shells, I saw, as I thought, a dead leaf move, and assume a position like a Satyrine butterfly sitting up with closed wings, but it proved to be *Phyllotettix rhombeum*, Felton, an Acridian with a leaf-like expansion of the pronotum. Mr. Shelford tells me that this curious insect was originally described, from a Jamaican specimen, in a letter from Samuel Felton, F.R.S., to Henry Baker, dated December 2nd, 1763, as *Cicada rhombea*.[1]

At Castleton a servant caught in his bedroom a big Acridian which bit like a bull-dog, actually drawing blood. When treated with chloroform it bit yet harder.

On February 6th, at Walderston, a Locustid came to light. Its head, the upper part of its face and base of the antennae were black; the elytra and greater part of the antennae were pale brown; the rest of the animal of a light yellow-green. On February 26th, during dinner at Port Antonio, one of the black waiters brought me another specimen on a salver—my wife said "like John the Baptist's head in a charger"—with the question, "Is this any good, sah?" To the great amusement of the company I produced a box from my pocket[2] and secured it, saying *sotto voce* to my wife: "I don't care much about these things and I already have one, but it will please the waiter." Three years afterwards I was startled to come across a description by Dr. Achille Griffini of *Gryllacris longstaffi*, *sp. nov.*[3] This travelled specimen had been sent by Mr. Shelford to Genoa,

[1] *Phil. Trans. Roy. Soc.*, 1765, vol. liv., Tab. vi., p. 55. Also Linnaeus, *Syst. Nat.*, Ed. xii. 1767. Tom. i. Pars ii. pp. 704, 705, where Linnaeus erroneously attributes the insect to—"Backer, auct. Angl."

[2] Why is it that the production of a pill-box from a collector's pocket affords such amusement to the looker-on? It is a strange and as yet unexplained psychological fact.

[3] *Ann. Mag. Nat. Hist.* (8), iii., p. 366 (1909).

where it was reported to present such unusual structural characteristics *as to make it possible that it should be referred to a new genus,* but the point could not be settled as both my specimens are males. [*Plate III., Fig. 6.*]

One day during a meal at Constant Spring I saw a curious spider (? *Gasteracantha* sp.) spinning a web on a rose in a flower-vase; its abdomen was protected with a hard spine-bearing carapace.

NOTES ON THE LAND MOLLUSCA OF JAMAICA.

By Mrs. G. B. Longstaff, F.L.S.

Jamaica is well known to be one of the richest regions in the world for land shells. Unfortunately we were there in the dry season, so it was more or less difficult to procure living specimens, nevertheless we managed to get a fairly representative series. Dead shells were found in great numbers and often in a remarkably good state of preservation. The wide extent of limestone is probably one reason for the richness of the molluscan fauna. Shells were observed to be most numerous on the limestones of Tertiary age, especially on the "White Limestone" of Oligocene age.[1] There were nothing like as many specimens on the limestone of Pleistocene age; this was very noticeable in the neighbourhood of Port Antonio, where both formations occur.

Shells were met with in great numbers in recesses or cavities of the limestone, also under loose stones in the so-called sinks. They were not only found thus in the wild uncultivated parts, but also in banana and yam plantations, where they were living both under stones and under leaves, and also attached to the stems of trees. Their frequency in cultivated ground stands in marked contrast to their absence from such habitats in other countries. In New Zealand, for instance, it was rare to find any but introduced species in gardens, quarries, &c., endemic forms being confined to the bush and other uncultivated land. This was also more or less the case in Ceylon.

None of the land shells of Jamaica attain a very great size, the largest being decidedly smaller than the well-known *Bulimus oblongus*, Müll., of Barbados and Tobago. Many, however, are characterized by great beauty of form and colour, and some are remarkable for the development of numerous teeth which in certain instances almost close the aperture, so that it is a matter of wonder

[1] "Geol. and Phys. Geogr. of Jamaica," by R. T. Hill, 1899.

how the animal protrudes itself or retires again. Some of the smaller species of *Pleurodonte*, Fischer, are instances of this latter characteristic. The genus is endemic to Jamaica, and we met with one or more species at every place we visited, in all twenty-three distinct forms being taken. The species with the exception of *P. acuta*, Lam., and *P. sinuata*, Müll., have a limited range. I found the former or one of its varieties wherever we went, except at Montego Bay, but the latter I only happened to meet with at Walderston, though Mr. Jarvis states that its distribution is general. Very fine examples of *P. acuta* were obtained near Walderston by turning over a heap of big stones by the roadside; these varied in the colour of the inside of the lip from deep mauve to light brown, the teeth also varied both in size and number, there being either one or two, or else they might be absent altogether. The small var. *sublucerna*, Pils., was taken abundantly among dead leaves near the Rio Cobre at Spanish Town, and small forms which come very near this variety were found at Mandeville. There occurred near Mackfield, as well as the typical form, a large variety which was remarkably flat and thin. In the district of Mackfield—which was particularly rich in shells—many of the smaller species with numerous teeth occurring there, such as *P. schroeteriana*, Pfr., *P. picturata*, Ads., *P. tridentina*, Fer., and *P. okeniana*, Pfr. The first-named was especially abundant under the sheaths of the leaves forming the stems of banana trees.[1] Two dead representatives only of *P. bronni*, Pfr., were found at Montego Bay. No species taken were common to both Montego Bay and Mackfield, but *P. sloaneana*, Shuttl., was found at the former place, and also at Montpelier. *P. invalida*, Ads., was met with both in the neighbourhood of Spanish Town and Constant Spring. *P. sinuosa*, Fer., was found at the latter, but appeared only to be represented by its var. *simson*, Pfr., at the former locality. Besides *P. acuta*, only two species were seen common to Mandeville and Walderston, viz. *P. bainbridgei*, Pfr., and *P. peracutissima*, Ads., the specimens of the former were dead. *P. cara*, Ads., was taken at Walderston alone. At this locality a small variety of *P. peracutissima* was found resembling *P. cara* in size and *P. schroeteriana* in the lighter colour of the keel. There are also two specimens of this peculiar form in the British Museum (Nat. Hist.). The commonest species at Port Antonio was *P. valida*, Ads.

[1] Mr. William Fawcett, F.L.S., whose knowledge of the plant is unrivalled, tells me that the Banana has no true stem. The flower bud is formed at the level of the ground and grows up through the leaf-sheaths until it makes its appearance where the leaf-stalks separate.

Other characteristic members of the Helicidae found were *Thelidomus aspera*, Fer., and *Eurycratera jamaicensis*, Gmel., both occurring in Manchester and Westmorland and the latter at Stoney Hill, near Kingston, as well; two species of *Dialeuca*, Albers, *D. conspersula*, var. *fuscocincta*, Ads., at Walderston, and *D. subconica*, Ads., at Constant Spring and Port Antonio; four species of *Zaphysema*, Pils., all of which were taken in Manchester, two also in Westmorland, and one, *Z. tenerrima*, Ads., had a still wider distribution occurring also in the Bog Walk; *Hemitrochus grammicola*, Ads., at Mandeville and Constant Spring. Six species of the curious bee-hive shaped *Sagda*, Beck, were found, and probably more were seen and passed over on account of the strong resemblance of the different species to one another. The largest form found, *S. magna*, was only taken at Mackfield, and the small transparent *S. pila*, Ads., was tolerably frequent at Walderston. The handsome *Zebra undata*, Müll., was abundant at Spanish Town, adhering to trees so firmly as to be removed with difficulty.

Several species of the graceful *Cylindrella* were taken, the white shells when hanging from limestone rocks looking like delicate stalactites, while the small, slender, dark brown specimens resembled cigars in miniature. Examples of *Lia*, Albers, and *Macroceramus*, Guilding, were also found. Specimens of the carnivorous *Glandina*, and of the ugly coriaceous slug *Vaginula*, were met with. Among the freshwater forms *Semisinus lineolata*, Ads., was perhaps the most characteristic; it was found both in the Rio Cobre, and also near Mackfield. Species of *Neritina* occurred at the latter locality as well as near Port Antonio.

A fairly good series of the *Helicinidae* was obtained. Besides the type *Helicina neritella*, Lam., which was widely distributed, occurring at Mackfield, Mandeville, Walderston and Port Antonio, there were found species of the subgenera *Poenia*, Ads., *Alcadia*, Gray, *Eutrochatella*, Fischer, and *Lucidella*, Swainson. *E. josephinae*, Ads., var. *pulchra*, Ads., taken at Mackfield, may be mentioned as an especially beautiful form with its delicate plaited frill round the periphery; when attached to the limestone rock its yellowish grey colouring renders it cryptic. The dark reddish-brown, hirsute epidermis of *A. palliata*, Ads., and allied species makes them cryptic also when found in the soil under pieces of rock or dead leaves.

Two species of the beautifully coloured and polished *Proserpina*, Gray, were taken: *P. nitida*, Sow., occurred in great numbers near Mandeville, it was also found at Walderston, and its variety, *planulata*, Ads., at Mackfield; this is larger and varies from canary

yellow to rich orange brown; *P. pisum*, Ads., seemed more uncommon, and two specimens only were met with at Mackfield.

Many other species were obtained, but space only admits of some of the most characteristic being noticed here.

I am greatly indebted to Mr. P. W. Jarvis for some of the names, and to Mr. E. Smith for access to the Chitty, as well as the fine general, collection in the British Museum (Natural History), with the aid of which I named the *Helicidae* and *Helicinidae*.

PANAMA.

March 11th and 12th, 1907.

On our return voyage the elements offered no obstacle to our entrance into Colon, and we at once took the train across the isthmus. The energy of our American cousins showed itself on every side. They have double-tracked the railway: on every eminence rise meat-safe-like barracks to accommodate the 80,000 labourers upon the pay-rolls. The French plant, being thought not quite up to date, has been replaced by machinery of the newest type and scores of locomotives, "steam-shovels," and the like, just stripped of their brass, are rusting by the roadside, a sad monument of wasted money and labour. Everywhere new lines are being laid, new roads are being formed, and the primaeval forest is being cleared away. Much vegetation has been destroyed by pouring paraffin oil on to the swamps to kill mosquitos. In short everything is being burned, blasted, and dammed.

Mrs. Longstaff caught sight of a Caiman in the Rio Chagres. How turbulent that treacherous stream may on occasion be, was shown by a large dredger that lay stranded many feet above the ordinary level of the river.

The huge American hotel at Ancon is pretentious, structurally bad, and ill-managed. Wire screens intended to exclude mosquitos make the rooms insufferably hot, but are so badly fitted that blue-bottles—not to say bumble-bees—could easily pass through the gaping cracks between the window linings and the screens.

When driving into the old Spanish city of Panama late in the afternoon a large butterfly settled in our buggy and was secured by Major Elton; it proved to be the Brassoline, *Opsiphanes cassiae*, Linn.

At the hottest hour of the afternoon I climbed the conical hill of

Ancon, about 500 ft. It was so steep that it was quite difficult to make one's way up over the short dry grass, and the heat was intense. Under such circumstances it was not possible to get very much, especially as the most productive part of the day had passed. Of two *Papilio polydamas*, Linn., and several *Euptychia oreba*, Butl., seen, one of each was captured. A *Phoebis* was seen but missed. A black and red *Heliconius* in dense scrub was quite inaccessible. The Erycinid *Mesene silaris*, Godm. & S. (which, by the way, was not represented in the British Museum) was observed to have a moth-like flight. Two females of *Terias delia*, Cram., were both of the dry-season form; certainly everything on that hot hill was dry enough! The Skippers, which always contributed so largely to the bag, were *Eudamus simplicius*, Stoll; *Megistias labdacus*, Godm.; *Morys valerius*, Möschl.; *Hesperia syrichthus*, Fabr., and *H. laviana*, Hew. Several of the beautiful *Utetheisa ornatrix*, Linn., were seen among grass. A Wasp, *Montezumia coerulea*, Sauss., was taken as well as *Sphex* (*Isodontia*) *costipennis*, Spin., and *S. nigrocoeruleus*, Tasch., which last Mr. Rowland Turner says is not a common insect.

Close to the top of the hill, in a somewhat scrubby wood, a procession of "Parasol-ants," *Atta sexdens*, Linn., was seen on the march across the path. I could follow them forwards for about two yards only where the column was lost in the dense undergrowth, but was able to trace them back about 8 yards to a tall tree from which they were bringing their "parasols," or pieces of leaf much bigger than themselves, a fact that may be verified by reference to the Hope Collection at Oxford.

A walk the next morning on lower ground near the railway was most disappointing in its results. *Danaida archippus* put in an appearance. I took three females of *Precis lavinia*, one of them the ocellated form, but two were very "dry," one of the latter being an aberration with very dark hind-wings, almost destitute of any fulvous colour; there were also a few *P. jatrophae* about. Of *Terias delia* I secured two intermediate males, and one dry-season female; as is so often found the "dry" characters were more marked in the latter sex. A pale *Hamearis erostratus*, Hew., was the sole Erycinid, a *Catochrysops hanno* the sole Lycaenid. There were but two Skippers, the common *Hesperia syrichthus*, and a male *Thymelicus athenion*, Hübn. The bug *Hypselonotus fulvus*, De Geer, was obtained by sweeping.

On our way back at night the Sphinx, *Dilophonota oenotrus*, Stoll, came to the lights of the train at Christobal station.

VENEZUELA.[1]

March 17th—March 31st, 1907.

I landed on the Venezuelan shore for the second time March 17th, 1907, but on this occasion the whole afternoon was spent in struggling with the authorities of the port, so that it was necessary to spend a night at La Guaira. The next day a few minutes' halt at Zigzag Station, about 1500 ft. up the railway to the capital, enabled me to sample the insect fauna. Butterflies were very plentiful, and I ran back to the railway carriage with specimens of *Actinote antaeas*, Dbl. & H.; *Euptychia phares*, Godart, a species that I did not see again; *Phyciodes leucodesma*, *Terias albula*, and *Hesperia syrichthus*; together with sundry Wasps, Bugs, and Grasshoppers. These included a large *Polistes* with dark wings and pale tarsi; the Bee, *Melipona capitata*, Smith, and the conspicuous greyish-black, purple-winged social wasp, *Synoeca cyanea*, var. *ultramarina*. The Bugs, narrow brown fellows, were *Catorrhintha guttula*, Fabr.

The railway, after many terror-inspiring twists, which made us glad that it was under British administration, gains access to the capital by a gap in the mountains on its western side.

Carácas stands at a mean altitude of 3200 ft. above the sea in North Lat. 10° 30′. The city is beautifully situated on a plateau sloping southwards to the Rio Guaire; this plateau is open to the East towards Petare, closed to the West by the Observatory Hill some 300 ft. above the plain; on the South it is bounded by two low ridges that separate Carácas from El Valle, but on the North it is dominated by a lofty range of mountains, which, rising abruptly from the valley, culminate to the North-West in Silla, 8760 ft., and Naiguata, 9300 ft.

The Observatory commands a grand prospect, but the path leading to it was far from productive, yielding only *Phyciodes anieta*, Hew.; *Synchloë lacinia*, Hübn., the dark form; *Leptotes cassius*, both sexes; *Terias elathea*, a male, an aberration of the "moderately dry" form in which there was no trace of the usually conspicuous longitudinal black streak, and scarcely any of the orange border thereto; also *Hesperia notata*, Blanch., the only example taken.

The village of El Valle stands at about the same level as Carácas, some four miles to the south, and as it is conveniently placed at the terminus of a tramway I visited it three times, but my first

[1] This section is reprinted almost as it first appeared in the *Entomologist's Monthly Magazine*, 2nd Series, vol. xix., 1908, pp. 69–76, 118–123.

visit was spoilt by heavy rain. A bluff on the outskirts of the village displayed sufficient flowers to attract a fair number of insects, the best of which was the large Skipper, *Prenes evadnes*, Cram., the only one that I met with, but a lane leading from the village southwards to a ford proved a better collecting ground. This lane, bounded on either side by a wet ditch and a flowery hedge, had an English look that was delightfully refreshing. Here were a number of the commoner butterflies, conspicuous among them the Brimstone, *Callidryas eubule*, f. *sennae*, of both sexes, though it was not as common as in Barbados or Jamaica; *Danaida archippus* (*plexippus*); *Actinote antaeas*, the beautiful yellow and black *Heliconius charithonius charithonius*; the brilliant red, black and white *Anartia amalthea*, flying, as usual, close to the water, but unfortunately in poor condition; the dingy Satyrine, *Euptychia hermes* (*camerta*, Cram.), together with its more attractive white-striped congener, *E. hesione*; there were also several males of the Common White of those parts, *Leptophobia aripa*, Boisd., and a male of the common *Terias albula*, a white member of a yellow genus. But besides these familiar forms there were several of greater interest, at all events to one new to South America. The small Nymphalines, *Phyciodes lelex*, Bates, and *P. liriope*, Cram.; a female of *Terias nise*, two male *Sphaenogona arbela*, Hübn., of an unusually pale form; a female of the fine *Daptonoura lycimnia*; a specimen of the large Ithomiine, *Mechanitis veritabilis*, Butl.; the black and white Lycaenid, *Polyniphe dumenilii*, Godart, and the Skipper, *Chiomara gesta*, H.-Schäff. But there were in addition several butterflies in that narrow lane which I did not meet with elsewhere in Venezuela; conspicuous among them, on the flowers of *Lantana camara*, was a specimen of the long-winged, richly silver-plated *Dione juno*, Cram., strikingly resembling *Colaenis julia*, Fabr. (which flew alongside of it), as regards its upper surface, but with a silvery underside that at once recalled the European *Argynnis lathonia*, Linn. Even more attractive was the essentially Neotropical Nymphaline, *Myscelia cyaniris*, Hew., grey with white stripes, shot with brilliant violet; conspicuous as this looks in the cabinet it is by no means so conspicuous when resting, as it is fond of doing, on light grey bark; one of them had suffered a symmetrical injury to both hind-wings suggestive of the attack of a bird. A black, white, and red butterfly seen fluttering at the bottom of a ditch turned out to be a small male of the truly exquisite *Papilio cereas cereas*, Cram., perfect in shape and finish, and with a marvellous blue gleam in certain lights; like many of its aristocratic genus it had an odour like musty straw. Less striking than the last

was an unusually small female of its soberly coloured congener, *P. polydamas*. Lastly, there were two Skippers peculiar to that lane, viz.: *Xenophanes tristis*, Boisd., and *Paches geometrinus*, Feld., both well meriting the specific name of the latter.

Near the village the Bug, *Oncopeltus cingulifer*, Stål, was taken on the wing, and the pale, prettily banded Wasp, *Polybia fasciata*, Sauss., was common. I noticed the close resemblance between the wasp and a small Syrphid which was flying about the same plants.

I tried another and very different collecting ground at El Valle—a combe on the southern side of the ridge lying immediately to the north of the village. A narrow path led through low scrub up to the crest, perhaps some 500 ft. above the river; most of my collecting was done, however, a couple of hundred ft. or so lower. A short distance up, near a lime kiln, several *Heliconius charithonius*, were seen, and close by the small black and white Lycaenid, *Polyniphe dumenilii*, was to be had in abundance; it is strange, but true, that this very small butterfly is the proud possessor of one of the strongest scents (?) very suggestive of pigsties, or at any rate of pigs! Several other Lycaenids were taken in this combe: *Leptotes cassius*, a male; *Catochrysops hanno*, two males, one of them with a faint, the other with a very strong sweet, *Freesia*-like scent; *Thecla rufofusca*, Hew., two; *Callipsyche thius*, Hübn.,[1] six; but the most interesting Lycaenid was a single rather sorry individual, of which Mr. H. H. Druce writes: "This is an interesting specimen. I cannot distinguish it from the well-known Eastern and African *Zizera gaika*, Trimen (*pygmaea*, Snell.), which has a wide range—India, Ceylon, Malaya, Australia, Solomon Is., South Africa (Rhodesia), &c.—but I have never seen it from America, and do not know that it has been recorded. Can it have been recently introduced?" This insect was certainly taken at El Valle, March 26th, 1907, but unfortunately my record leaves it in doubt whether it was taken near the river or up the combe.

The only Satyrines found were a few *Euptychia hermes*, but the Nymphalines were as usual well represented, conspicuous amongst them being the bright little *Cybdelis mnasylus*, Dbl. & H., looking for all the world like a miniature *Hypolimnas misippus*; this is the only place that I came across it, but here it was quite common, fluttering about low plants, and never settling for long. *Phyciodes*

[1] Mr. H. H. Druce says: "This is the same as *Thecla agra*, Hew.; my males from Venezuela have a white tip to the fore-wing, which is not present in Jamaica specimens."

place for Satyrines, which were fairly numerous, being represented by *Euptychia saturnus*, Butl., three, a species that I did not find elsewhere; *E. hermes*, five; *E. pharella*, three; and *Oressinoma typhla*, three, one of them very small, this is a butterfly that is by no means fastidious, often flying when the sun is not shining.

Nymphalines were quite unusually scarce, the only species captured were *Phyciodes lelex*, and *P. anieta*. The sole Lycaenid was *Polyniphe dumenilii*. No *Papilio* was taken.

Of the Pierines, those taken were *Pseudopieris nehemia*, six males (with a slight, or moderate, flowery scent), and a female; *Sphaenogona arbela*, a male of the usual yellow form; also three males of *Terias phiale*, one of them an aberration having more black than usual on the hind-wing and but little yellow.

Heliconius was poorly represented by a single *charithonius*, but the Ithomiines were more numerous, and included *Ithomia andromica*, Hew., two; *Aëria eurymedia*, Cram., one; *Hypoleria ocalea*, Dbl. & H., one; and *Athesis clearista*, Dbl. & H., a female.

Actinote antaeas was of course present, and there were a few Skippers, to wit, *Hesperia syrichthus*, one; *Eudamus eurycles*, one; *Hesperia uniformis*, Plötz, one (a species recorded by Plötz from Brazil) and a worn insect that is probably *Chiomara gesta*, H.-Schäff.

I also secured specimens of the pretty orange, black-bordered, day-flying Geometer, *Devarodes hypocritaria*, Guen. (*simulans*, Walk.), and of the smoky, black and white Oenochromiid, *Phaeochlaena circumfumata*, Warr.; together with these was a Uraniid, *Epiplema obliviaria*, Walk., of which there are but two worn examples in the British Museum. A beetle, *Euphoria* (?) *morosa*, Jans., was taken on the wing.

But I reserve to the last my favourite hunting ground at Carácas, which I visited altogether four times during my short stay. A few minutes' walk beyond the Puente 9 de Febrero brings one to the closed Cementerio Hijos de Dios, to the right of which the path crosses a deep "barranco" (ravine) where there are usually a number of *Actinote anteas*: this is an unmistakable Acraeine; it has a slow flight, and when at rest the fore-wings are always drawn back completely within the hind-wings, so as to give the insect a very long, drawn-out look. It is tenacious of life, but I did not detect any scent. An aberrant specimen had no ferruginous at the base of the fore-wing and very little ochreous about it.

Beyond the barranco the path leads across a field past a cottage and round the head of another smaller barranco—where the effects of denudation with fairly well-formed earth-pillars may be studied

—it then strikes a small water-course, or leat,[1] cut along the mountain side. The path may be followed eastwards, beside the channel, along the contour at a height of about 3600 ft. above the sea. A more delightful walk can scarcely be imagined: to the left high mountains, to the right and at one's feet the city, yet for all practical purposes miles away, since the numerous barrancos keep all but a few farmers well out of reach. There are plenty of flowers along the water-course and plenty of insects. A walk of about a mile brings one to the source, a small mountain torrent rising in the cloud regions far above, but compelled by the patient farmers to water their lands below. It is easy to scramble down the bed of the stream, but I found it better to take a path to the right leading through a picturesque farmyard, below which another water-course is reached, about 120 ft. lower down the mountain. Here *Leptophobia aripa* was usually in abundance, together with the beautiful day-flying Arctiid, *Utetheisa ornatrix*. The male White has a sweet scent suggesting orange blossom; in an aberrant Arctiid the spots on the underside showed through the wings, making the moth look very different from the usual form. Turning again to the left along the channel the source was soon reached. A strip of forest on either bank (presumably retained to preserve the water) hid the torrent from view. Here was all that a tropical collector could desire—trees, flowers, shelter from wind, sunshine (in the forenoon), and above all moisture. It was a little before 4 p.m. on the rather dull afternoon of March 20th, 1907, that I first scrambled up this gully. I had met with a few Ithomiines previously, but only odd ones, here and there; now it was my pleasure to see what I had read about.

Bates, in his classical paper on the *Heliconiidae*, writing of the genus *Ithomia*,[2] says:—"They are prolific insects, and gregarious in their habits, flocks of many different species associating together. Their flight is low and weak; and they affect only certain parts of the forest, generally shady hollows, where many hundreds may often be seen sporting together, though not an individual is found in any other part of the neighbourhood."—*Trans. Linn. Soc.*, vol. xxiii., p. 539, 1862.

Again:—"The flocks of Butterflies, all of the same colour, and undistinguishable from one another when on the wing, which fly together in the same dry hollows of the forest. . . ."—*Ibid.*, p. 541.

[1] This is just what a Madeiran Portuguese would call a *levada*; I have had much difficulty in learning the Spanish equivalent, perhaps *toma* or *acueducto*.

[2] The *Ithomiinae* are now held to be quite distinct from the *Heliconiinae*.

Alongside the right bank of the mountain stream was a comparatively level strip of ground, some six or eight yards wide, damp, and in places swampy, covered for the most part with the Life-plant (*Bryophyllum calycinum*, Salisb.). The place was overshadowed by what appeared to be a species of Coral-tree, or "Bois immortel," as it is called in Trinidad (*Erythrina* sp.), and there was an undergrowth of Wild Coffee and a few Bamboos. As I pushed along, my movements suddenly disturbed a number of butterflies, which fluttered about in clouds, looking with their transparent wings almost like *Tipulae*, only more ghost-like. Sometimes their wings would catch the light with an iridescent gleam, but more usually little could be seen save the opaque white marks upon their wings. Of course the more thickly scaled forms were more conspicuous, but as a rule all the black portions of the insects were invisible. It was a wonderful sight, but quite bewildering. Two or three sweeps of the net entrapped a dozen or so. I took back that afternoon thirty-five specimens, which I imagined included three or four, possibly five or six species. In truth, there were eleven species belonging to eight genera!

A visit to the same spot the next day produced a similar result, the hour was earlier and the Ithomiines were not so closely packed, yet I took home thirty specimens, which proved to belong to nine species, three of which I had not taken on the first day. A third visit failed to add further to the list, which stands as follows:—

Athesis clearista, Dbl. & H. . . .	3
Ceratinia coeno, Dbl. & H. . . .	17 (abundant).
Ceratinia dionaea, Hew.	2
Pteronymia latilla, Hew.	16 (very common).
Pteronymia asopo, Feld.	3
Pteronymia victorina, Hew. . . .	2
Ithomia agnosia, Hew.	6
Ithomia cymothoë, Klug.	8
Ithomia iphianassa, Dbl. & H. . .	6
Ithomia sylvella, Hew.	1
Hymenitis andromica, Hew. . . .	19 (abundant).
Leucothyris phemonoë, Dbl. . . .	3
Hypoleria ocalea, Dbl. & H. . . .	1
Aëria agna, Godm. & S.	1

The last of these flew higher than the rest, or possibly more might have been taken.

A total of eighty-eight specimens, belonging to fourteen species

divided amongst eight genera of one group of butterflies, is a sufficiently remarkable record for three visits to a strip of ground which certainly did not exceed 50 yards in length by 10 yards in width. While fully bearing out Bates' account, it forms a striking exception to Darwin's rule that nearly allied species are seldom found in close competition on the same ground.

On another occasion I met with a similar experience. On March 28th, 1907, a hot sunny morning, as I was walking along the upper water-course where it runs through the wood almost clinging to the face of the cliff (perhaps a quarter of a mile from the previously described locality), passing under the shade of a large tree I disturbed a crowd of butterflies so dense that fourteen were easily netted in two or three swoops. Ten of these, which all proved to be *Ithomia sylvella*, were pinched; four of them got away. In this instance the butterflies were confined to some 4 or 5 yards of the narrow path, and it was almost a "pure culture" of that singularly delicate little species, indeed, the only other butterflies of the genus taken at that spot were two specimens of *Athesis clearista*, and single specimens of *Pteronymia latilla*, and *Dircenna jemina*, Hübn. (*iambe*, Dbl. & H.). I may add that I have no reason in either case to think that the Ithomiines were drinking at the stream.

Judging from the British Museum series, *P. victorina* and *L. phemonoë* are not very common insects. In four or five of the above species I found more or less scent of a disagreeable character, recalling stables or pig-sties. In some examples I thought the scent was connected with the brushes, or fringes, near the costa of the hind-wings, but unfortunately my observations did not yield very definite results.

But besides Ithomiines there were plenty of other butterflies along the banks of that stream and the water-courses leading from it. To begin with the less exciting Satyrines. There were *Euptychia hermes*, and the smaller *E. pharella*, the latter very common among grass and less chary of sunlight than many of the family; one had a small symmetrical injury to the tips of the fore-wings, possibly inflicted by a bird; but the more attractive *Oressinoma typhla* was, on the contrary, always found in the shade.

The commonest Nymphaline was the tiny fulvous *Phyciodes anieta*. It was in this favoured spot that I first made acquaintance with the beautiful genus *Dynamine*, capturing three *theseus*, Feld., and one *geta*, Godm.; the insects of this genus fly much like Blues; *Anartia amalthea* flew over the water of the levadas, and *Precis lavinia* was as usual easier to see than to catch. A single specimen

of *Pyrameis myrinna*, Doubl., was captured at the flowers of a Composite creeper near the farmhouse, while the shades of the wood yielded the larger game, *Victorina stelenes* and *Amphirene epaphus*, Latr.; one of the last-named was drinking in the bed of the stream, where I had the bad luck to miss a *Callicore*. But of all the beautiful butterflies seen there by far the most startling was my first *Morpho*. A huge bird-like creature sailing down the gully, now giving an azure flash, now almost disappearing as the upper surface turns away —flash, flash, flash, and it is out of sight! Shortly afterwards I had the pleasure of beating out of a bush a male *Morpho peleides*, Koll., and netting it as it flapped away.

The sole Danaine was a male *Danaida archippus*, but the Acraeines were represented by a number of *Actinote antaeas*, though that species was commoner in the outskirts of the city; of its congener *A. hylonome*, Doubl., I secured but a single specimen. The only Erycinids taken were a couple of *Charis argyrodines*, Bates, and one of the conspicuous black, yellow, and scarlet *Lymnas jarbus*, Fabr.

Heliconiines were not common, but I took *Heliconius charithonius*, and two of the beautiful black and red *H. hydarus*, Hew. (one of the species into which the beautiful *H. melpomene*, Linn., has been split up); the latter were both males, one only of which had a very strong odour, like acetylene, or, better, as Mr. G. H. Sworder of Tobago (who was familiar with the insect and its scent) suggested, hazeline, a preparation of the Witch-hazel (*Hamamelis virginica*). This insect is tenacious of life.

I got but one *Papilio*, but its beauty was striking even among so many fine insects, for a male *P. cymochles*, Doubl. (*crithalion zeuxis*, Lucas), feeding on the flowers of *Lantana* is a sight worth going far to see. Its handsome black, scarlet, and cream-coloured livery is in itself a feast of colour, but when that marvellous violet-blue gloss is seen, words altogether fail one.

Among the Lycaenids the wide ranging *Leptotes cassius* was by far the commonest, the sexes occurring in about equal numbers; next in order of abundance came the chocolate-scented *Tmolus palegon*, Cram., which frequented the flowers of a Composite shrub (? *Vernonia scorpioides*, Pers.); of *Thecla rufofusca*, Hew., I captured two, but of the following only one each: *T. crolus*, Cram.; *T. togarna*, Hew.; *Theclopsis tephraea*, Hübn. (this had a peculiar, strong, rather disagreeable odour); *Callipsyche thius*, and *Catochrysops hanno*, this last sitting head downwards and opening its hind-wings at intervals.

The Pierines were represented by a fair number of species, but few of them were common, indeed, of the following single specimens

only were taken: *Terias nise*, a male with a strong scent like Pink Bindweed; *T. leuce*, Boisd., a female, the only specimen met with; *T. elathea*, a male, an aberration with the black streak obsolescent; a male of the mis-shapen *Enantia (Dismorphia) melite*, Clerck, had a scent like mignonette, two were netted, but unfortunately the female got away; and the "Black-White" *Euterpe critias*, Feld., a male; as regards the last-named I fear I did not notice at the time how closely it mimics some of the black and red *Papilios*, notably *P. serapis*, Boisd. (? *iphidamas*, Fabr.), a species that I took at Cartagena. The genus *Terias* was much to the fore; in addition to those already mentioned several *T. albula* were taken, some of them remarkably small; also of *T. phiale* four males, some of them having a slight flowery scent; and of *T. delia* three females, all of dry-season type, and one of the extreme "dry" form named by Butler *persistens*. Three females of *Meganostoma cerbera*, Feld., were captured; this species, of which Felder called the dry-season form *therapis*, appears to me to be quite distinct from *M. caesonia*, Stoll, but whether distinct or not, the delicate combination of pink and yellow on its under surface makes it a very beautiful butterfly; one example, in spite of its sex, had a slight, very sweet scent, suggesting clover. Of *Daptonoura lycimnia*, Cram., I took one of each sex, the male had a strong, very sweet scent of the *Freesia* type. Altogether I took six specimens of *Sphaenogona arbela*, four males of the ordinary yellow form, one of the form *xanthochlora*, Koll., and a female of the unusual pale form, with hind-wing nearly white; two of the males had a slight scent which might, perhaps, be compared to that of mignonette. Of *S. gratiosa* I took a female. Undoubtedly the most conspicuous Pierine was the large and handsome Brimstone *Amynthia maerula*, Fabr. This was only seen on one especially hot morning (March 21st) when several of both sexes were observed close by the Ithomiine locality flying strongly; I only secured one male, and as the day wore on the species disappeared.

There was more than the usual crowd of Skippers; but in the Neotropical Region Skippers are so common, often so inconspicuous in colour, and the allied species so difficult to distinguish that the collector is apt to neglect them in the presence of more attractive game; for truly the most scientific entomologist is but human! Nevertheless of *Prenes nyctelius* I took two; of *Heliopetes laviana* three; of *Hesperia syrichthus* two. Of the long-tailed *Eudamus proteus* and the white-striped *E. eurycles* but one each was secured, though there were plenty about; of *Gorgythion begga*, Prittw., three. Of all the following there were but single examples in my bag: *Cycloglypha*

thrasybulus, Fabr.; *Chiomara gesta* (the three species last named all curve the fore-wings downwards like our *Thanaos tages*, Linn.); the conspicuous black and red *Pyrrhopyge charybdis*, Dbl. & H.; the large grey *Larentia*-like *Mylon zephus*, Butl.; the black *Cogia calchas*, H.-Schäff.; *Epeus veleda*, Godm. & S.; *Mnestheus itona*, Butl.; *Pellicia* sp. (*prop. bromio*, Mabille, *teste*, H. H. Druce); *P. dimidiata*, Plötz (*didia*, Möschl.); *Metron leucogaster*, Butl.; *Megistias telata*, H.-Schäff.; *Methionopsis ina*, Plötz (*modestus*, Godm. & S.), with a curiously long proboscis; *Thymelicus dares*, Plötz; and *Niconiades merenda*, Mabille. But the most attractive of the group was tbe black *Carystus coryna*, Hew., with its brilliant silver-washed underside; the only specimen seen—just where the upper water-course leaves the stream—was settled upon a mass of silvery-white micaceous shale, which shone in the sunlight with tbe same metallic lustre as the butterfly. Possibly the result of mere chance, this is certainly the most remarkable instance of cryptic colouring that I have happened upon.

A few day-flying Moths taken in the same locality must be mentioned; single specimens of each occurred. The *Arctia*-like Syntomid *Ctenucha venosa*, Walk., at the flowers of a white Composite; another Syntomid, more *Zygaena*-like, was *Macrocneme maja*, Fabr., found in the bed of the stream, apparently drinking; the black Geometer with a creamy-white transverse bar across the fore-wings, *Ephialtias tryma*, Schaus; *Heterusia atalantata*, Guen.; the black, orange-striped Geometer, *Josiomorpha cruciata*, Butl., which proved tenacious of life; and the transparent, sea-green Pyrale, *Theages vestalis*, Schaus.

The most attractive flowers were two shrubs of the Natural Order *Compositae*; one of these, with racemes of white flowers, was especially attractive to bees, another, with purple flowers, I take to have been *Vernonia scorpioides*. Then there was a *Hyptis* of sorts, and of course *Lantana*.

The commonest Bee was *Melipona capitata*, Smith; I also met with *M. amalthea*, Fabr., and another species of the genus not yet named; then there was an *Augochlora* and a *Nectarina*; I took two specimens of a *Megachile* represented in the National Collection, but nameless. The only Honey-bees were of the *mellifica* form, and were captured on the small white flowers of a Papilionaceous shrub. The Bumble-bees had a handsome representative in *Bombus violaceus*, Lepel., which almost rivals *Xylocopa* in size and colour; it was quite common. The only Carpenter-bee was *Xylocopa aeneipennis*, De Geer, and I took but one of that. In the big barranco near the cemetery I took at flowers a single example of the brilliant metallic-green Bee,

Euglossa cordata, Linn. Mr. G. W. Sworder told me that in Tobago *Euglossa* specially frequents the flowers of the Orchid, *Coryanthes maculata punctata*, Lindl. The structure of the Orchid is remarkable, and so is the length of the proboscis of the Bee, and doubtless there is a relation between them.[1]

The commonest Wasp was the large *Polistes annularis*, a distinctly formidable-looking animal with a pale cream-coloured band, but dusky-winged; of *P. subsericeus*, Sauss., I got but one; there was also an unnamed *Polistes*, a large insect with dark wings and pale tarsi. Of *Polybia* there were several species; *P. nigra*, Sauss., *P. angusticollis*, Spin., and *P. occidentalis*, Oliv., the latter obtained by sweeping, but none of them were common. Of *Odynerus* I took a single specimen, a female. The Social Wasps of the genus *Zethus* were represented by the greyish-black, purple-winged *chalybeus*, Sauss., and by another species unnamed, of which the British Museum possesses an example from Nicaragua; it is allied to *Z. hilarianus*, Sauss. There were also two of another social wasp, *Synoeca cyanea*, var. *ultramarina*. I captured three of the somewhat dingy, long-waisted *Mischocyttarus labiatus*, Fabr., var. *drewseni*, Sauss., and one of a Sphex of the genus *Oxybelus*. The harmless Ant, *Camponotus rufipes*, Fabr., was frequently seen.

I had little time to give to Bugs or Beetles, and therefore naturally only took such as obtruded themselves on my notice. A *Lygaeus* nearly allied to *circumlatus*, Stål, had no representative in the National Collection. Another bug of the same family, *Dysdercus ruficollis*, Linn., was taken on the wing. *Euchistus bigibbulus* was a Jamaican acquaintance.

Curiously enough only one solitary Beetle came in my way. This was a Dung-beetle, a species of *Canthon*, which Mrs. Longstaff found in the water of a tank near the above-mentioned farm; it was of a species not represented in the British Museum. This, with a very elegant Demoiselle Dragon-fly having carmine patches at the base of the wings (near to *Agrion brightwelli*, Kirby, and *caja*, Drury), completes my list of captures in the best locality that it has been my good fortune to visit.

Close by the Ithomiine swamp was a small cave which I entered in the hope of finding Lepidoptera at rest, but did not see any living creatures save crowds of bullet-bodied, long-legged Harvestmen (*Phalangium*). I have never before or since seen any approach to such a number of these animals together.

There is a difference in the meaning of the word "grand" in

[1] See Darwin, "Fertilization of Orchids," p. 175.

Spanish and in English. In the former language it maintains its primitive meaning of "large," as in Rio Grande. That is probably why it occurs in the phrase "Grand Hotel," a building of which the grandeur is not obvious. To a visitor to that hostel I would give three pieces of advice: (1) Walk delicately across your bedroom until you are quite sure that the floor will bear your weight; (2) in communicating with the Chinese washerman, use Pidgin English in preference to Spanish; (3) don't refuse Venezuelan black beans, they are much better than they look. But whatever criticisms might be passed on the Grand Hotel from the point of view of mere human guests, there can be no doubt that to Moths and Locustids the arc-light in its patio was extremely attractive. It is indeed somewhat remarkable that a light in a courtyard enclosed on all four sides, and that near the middle of the city, should attract so many insects, but two things may possibly contribute to this result: (1) the light is nearly as high as the lowest side of the buildings enclosing the patio, and (2) the ground on two sides is higher than the city.

The Visitors' List is as follows:—

Syntomidae.—*Cosmosoma teuthras,* Walk., one; the Arctiid-like *Eucereon setosum,* Sepp., two.

Arctiidae.—*Bertholdia specularis,* H.-Schäff., one, a beautiful grey and scarlet insect, with much of the fore-wing transparent; *Ammalo insulata,* Walk., two, paler and not so yellow[1] as the Jamaican specimens, a remark which also applies to the British Museum series; *Utetheisa ornatrix,* two; the striking, but I believe common, *Ecpantheria muzina,* Oberth., one; the transparent-winged Pyraloid, *Psychophasma erosa,* H.-Schäff., one.

Noctuidae.—*Cirphis latiuscula,* H.-Schäff., one; the cosmopolitan *Chloridea* (*Heliothis*) *armiger,* Hübn., one; the Boarmiid-like, purple-tinged *Synia hypnois,* Hübn., one; the huge and variable *Erebus odorus,* Linn. (which was quite common), ten; *E. zenobia,* Fabr., one; the large handsome *Ophiusa tropicalis,* Guen., one in fine condition; the Yellow-underwing *Hypocala filicornis,* Guen., one; the White-underwing *Melipotis fasciolaris,* Hübn., one, which Sir George Hampson says is an uncommon variety of a common species; another *Melipotis* Sir George says is identical with the specimen marked by Butler, *surinamensis,* Möschl.

Deltoidae.—*Tortricodes*[2] *orneodalis,* Guen., an insect with long palpi and curiously incised fore-wings, two.

[1] For the greater prevalence of fulvous or yellow in Jamaican butterflies, as compared with those from the mainland, see p. 290, *supra*.

[2] Guenée gave this name to the Deltoid genus in 1854, but he had himself used

SPHINGIDAE.—*Dilophonota ello*, Linn., three.

NOTODONTIDAE.—*Dicentria* (*Phya*) *laciniosa*, H. Edw., one.

GEOMETRIDAE.—The large and variable Boarmiid *Oxydia vesulia*, two, a Jamaican acquaintance; *Alcis syrniaria*, Guen., a female [not very unlike our *B. betularia*]; *Semiothisa enotata*, Guen., one [a moth very like our "Peacock"]; *Eucosmia affinitata*, Guen., one [obviously allied to our *Scotosia dubitata*].

PYRALIDAE.—By far the most remarkable was the huge ochreous, very *Sphinx*-like[1] Galleriid, *Myelobia paleacea*, H.-Schäff., four inches in expanse. I got two specimens, whereas the British Museum has but one [Plate III., Fig. 8]. Hardly less remarkable is *Terastia meticulosalis*, Guen., which appeared to be rather common, at all events I got four specimens; though not quite so large, its resemblance to our Angle-shades is striking, there are prominent tufts of scales along the sides of the abdomen; *Glyphodes quadristigmalis*, Guen., one; *G. nitidalis*, Cram., one; *Maruca testutalis*, Guen., one.

The large Skipper, *Perichares corydon*, Fabr., turned up in one of the court-yards by day, and a recently dead specimen of the Nymphaline, *Catonephele nyctimus*, Westw., a male, was found on the floor.

With the moths were numerous big Locustids, a green Phaneropterine, allied to the Katydid, and a brown Conocephaline, as well as the beetle, *Phileurus valgus*, Linn.

On March 29th, proceeding to La Guaira to join the homeward-bound steamer, we got out at Zigzag station, 1500 ft. above the sea, and completed the journey on foot, a walk that I should much like to repeat. The road, right down to the coast, presented all the appearance of very heavy rain within a few days previously. Insects were most numerous between the station and about 1000 ft.; below this vegetation became sparse, and later on clouds overspread the sky. *Zinckenia perspectalis*, Hübn., occurred close to the station. The most abundant butterfly was *Phyciodes leucodesma*, with its somewhat gliding flight, but *P. anieta* and *Terias albula* were also common, as was the handsome scarlet and black *Heliconius hydarus*. A much smaller, but lovely black and red butterfly, *Haematera pyramus*, Fabr., was taken on the railway track, Other Nymphalines captured were *Colaenis julia*, two; *Nica canthara*, Doubl., one; *Anartia amalthea*, two; *Dynamine sara*, three; *Synchloë lacinia*, two of the dark form, another of f. *saundersi*, and *Cystineura cana*, two, a

the same name, in 1845, for the well-known Tortrix, *Cheimatophila hyemana*, Hübn. —*Teste* J. H. Durrant.

[1] Another of the genus is called *smerinthoides*.

ghostly looking thing with gliding flight somewhat like that of a *Neptis.*

The only Ithomiines met with were the musty-smelling *Tithorea furia*, Stdgr., of which I took a female at about 1300 ft., and *Pteronymia victorina*, of which I took one, and possibly saw others, at about 1000 ft. Of *Eueides isabella*, Cram., f. *hübneri*, Ménét., I got but a single example which seemed to be most unwilling to die. The Erycinids were limited to *Nymphidium molpe*, and *Charis argyrodines*, one of each.

Satyrines were notable for quality rather than quantity, single specimens were taken of *Euptychia hermes*, of the wet-season, or ocellated form; *E. hesione*, and *E. mollina*, Hübn., the last-named a whitish species not taken elsewhere.

Skippers were but moderately numerous: those taken were: *Chiomara gesta*, one; the very neat little *Heliopetes domicella*, three; *Zophyrion satyrina*, Feld., one, a species well named, since the ocelli on its under surface are very suggestive of a Satyr; and *Staphylus mazans*, Reak. (*ascalaphus*, Stdgr.), one.

If Skippers were comparatively uncommon, Blues were decidedly scarce, for my bag included only *Thecla rufofusca*, one, taken at about 750 ft., and *T. togarna*, two, one taken just below Zigzag, the other as low as 500 ft.

Pierines were fairly plentiful but not so easy to catch, conspicuous among them, though not really common, was *Callidryas eubule;* the specimens were large, and tending to the wet-season form. Of *Sphaenogona gratiosa*, a female was taken, but others were seen; a female *Daptonoura lycimnia*, f. *polyhymnia*, Feld., contrary to precedents, had a rich sweet scent.[1] Of *Pieris* (*Perrhybris*) *calydonia*, Boisd., I brought home two males, both scented like our *G. brassicae*, but more distinctly, also a male of another *Pieris*, of which Dr. Dixey says:—"It is near to *P. sevata*, Feld., and appears to be identical with three specimens from Venezuela placed in the National Collection under *P. sincera*, Weymer, but which might well be considered as a distinct species, or at any rate local race." This was taken at an altitude of about 1300 ft. close to the track. There were several good-sized Whites about that declined to be caught, it is possible that among them there may have been others of this interesting species. It had a faint, sweet, flowery scent; Dr. Dixey says that its scent-scales are both numerous and large.

Between 2 and 4 p.m., from about 1000 ft. down to about 500 ft., the Hypsid day-flying moth, *Phaloë lorza*, Boisd., was in

[1] See below, p. 511.

abundance. Its flight is slow and heavy, suggesting a pale, dingy *Heliconius;* nine specimens were taken, eight of them proved to be females. Among the last butterflies taken were *Phyciodes liriope,* Cram., and a tattered *Hypanartia lethe,* Fabr., both at about 750 ft. The Pyrale, *Conchylodes platinalis,* Guen., occurred near the same contour-line. The only insects of "other orders" taken were *Synoeca cyanea,* var. *ultramarina,* and a *Canthon* found by Mrs. Longstaff.

At the decidedly dirty Hotel Neptuno, a fine specimen of the large Brassoline, *Caligo memnon,* Feld., was awaiting my arrival; it had been pinned upon the wall two days before by the obliging interpreter who knew my fancies. Another redeeming feature was the excellent coffee.

The next morning was devoted to a stroll along the coast towards the east, anxiety as to the arrival of the steamer preventing any lengthy expedition. The best spot reached was a neglected cemetery by the sea-side, where we found *Phyciodes leucodesma,* common; *P. liriope; Anartia amalthea,* tattered; *Terias albula,* common, one very large; *Pieris phileta* (*monuste*), two males of the wet-season form—this species I have always met with close to the shore; *P. calydonia,* a male; *Nica canthara,* two; *Mechanitis veritabilis,* one; *Heliopetes arsalte,* one; another Skipper was *Bolla* sp., of which three specimens were obtained (Mr. H. H. Druce says that there is one specimen of this species in the Godman-Salvin Collection unnamed); and *Ageronia ferentina,* settled on the pale grey trunk of a palm, which it closely matched in colour. *Danaida archippus* was seen a little way beyond the cemetery on a purple-flowered *Asclepias.*

The *Aculeata* found in the graveyard were the Carpenter-bee *Xylocopa aeneipennis,* well protected in its hard integuments; the formidable dusky-winged *Polistes annularis,* and the tiny Social Wasps, *Nectarina augusti,* Sauss., whose brown oval nest, about 4 inches by 2½ inches, was on a shrub about 3 feet from the ground.

Near the cemetery at La Guaira (as well as on the way down from Zigzag) Mrs. Longstaff took a species of *Canthon,* a beetle of which the British Museum has a plentiful supply but unnamed.

While walking down to the ship I picked up from the pavement a fine Water-beetle, *Hydrophilus insularis,* Casteln.

So ended my fortnight in Venezuela, yielding in butterflies alone 492 specimens, of 124 species, of which 53 were represented by single examples. Let me add that I found the Venezuelans, more especially the country folk, civility itself, and my operations were in no wise interfered with.

Trinidad.[1]

SECOND VISIT: April 1st and 2nd; April 11th—14th, 1907.

We reached Trinidad on our homeward voyage, on the morning of Easter Monday. The Queen's Park, or Savannah as it is usually called, reminded me irresistibly of Clapham Common, the more so as it was covered with crowds of children and young people disporting themselves at football (T. 80° F.), cricket, and kiss-in-the-ring. It is true that the Savannah presented points of difference from the surburban Common, as, for instance, a crescent of mountains from 1500 to 2000 ft. high made a better background than rows of villas, and a fine cabbage-palm here and there took the place of the somewhat pudding-shaped horse-chestnuts, while, lastly, nearly all the players at the varied forms of pastime were of ebony hue;—nevertheless the Clapham-like impression sticks in my mind. The present ideal of the young West Indian negro is to be taken for a cricketer, and he dresses accordingly.

The following story which was told me by an eye-witness amply confirms the popular opinion as to the hardness of the negro's cranium. The occasion was a cricket match, whether in Barbados or Trinidad I cannot remember, the players including both whites and blacks. A certain white boy was a local terror, owing to the unusual swiftness of his underhand bowling. A lusty negro lad was at the wicket, the ground was hard, and one of the dreaded balls rose and struck the batsman full on the forehead with considerable force. The spectators expected to see him fall stunned; but he simply rubbed his head, saying, "You must be careful, Mr. Arthur; just think, that might have hit me on the leg!"

Most of my collecting was done on the Ariapeta Road (or rather path, for it is little more) above St. Ann's, where I worked up to perhaps 1500 ft. I did not revisit Maraval, but one day we took train to San Juan, and another day visited the Pitch Lake at La Brea. We were exceptionally fortunate in having a cool breezy day for La Brea, as it is famous for its heat, and viscid pitch is not a material that any one would choose to stroll upon under a sultry sun. Nevertheless it was quite hot enough to make us thoroughly enjoy the most delicious green pine-apple that I ever happened upon. Some negresses annoyed my wife by staring at her, but one of them, when rebuked for her rudeness, said: "If you were the Blessed Virgin herself come to the earth, I should look at you."

[1] It is convenient to deal with April 1st—14th, as one visit, broken by a trip to the neighbouring island of Tobago.

On the short voyage from Port of Spain to Scarborough we had been disagreeably impressed by the odour pervading our cabin, but did not learn till some days afterwards that it had been subjected to disinfection after the removal of a man suspected to be suffering from yellow fever! When the small steamer reached Port of Spain on its return from Tobago, the porter of the excellent Queen's Hotel was there to meet us with the cheery message that the best hotel in the West Indies had been closed by order of the Governor, in consequence of two deaths from yellow fever. The obliging porter took us to hunt for quarters, since there was no possibility of getting away for four days, when the "Orinoco" would be due homeward bound. The second-best hotel was, as might have been expected, absolutely full. The best boarding house in the town had also been closed in consequence of a case of fever, but we ultimately found quarters at the Colonial Hotel, of which all that I need say is that it was distinctly better than the Neptuno at La Guaira, although my wife *did* have to sit up half the night in active pursuit of *Arthropoda* belonging to orders in which, greatly to Mrs. Longstaff's annoyance, I declined to take any interest, possibly because they took but little interest in me.

A male *Danaida archippus*, the only insect of its group, was taken at La Brea. Near San Juan, I took four specimens of *Tithorea megara*, Godart, three males and a female, they were flying slowly in a shady wood; the males had a strong, sweet, flowery scent, like that of *Stephanotis*, but with a spicy element; I thought it was associated with the tufts. A single specimen of *Ithomia pellucida*, Weymer, occurred in a wet place on the Ariapeta path at an elevation of about 500 ft.

The Satyrines, though confined to one genus, were somewhat numerous. *Euptychia hermes* was extremely abundant; of *E. renata*, Cram., several, and of *E. hesione* many were met with on the Ariapeta Road, the latter did not seem to mind rain; one example had suffered a symmetrical injury to both hind-wings; again, at about 500 ft., I came across two *E. penelope*, Fabr., also two of the delicately beautiful *E. ebusa*, Cram., which is almost black, with violet hind-wings.

At San Juan an aberrant specimen of *Actinote antaeas* was secured; the wings were all paler than usual, and the intermediate black lines on the hind-wings wanting.

The two very similar, and almost equally handsome scarlet and black *Heliconii*—*hydarus hydarus* and *euryades*, Riff., were both captured. The former was rather common above St. Ann's, at about

1000 ft., and one was taken at La Brea. A female *hydarus* had such a strong Witch-hazel odour that it was quite perceptible through the net; two males, in which little or no scent could be detected during life, had a decided scent when their papers were opened at Oxford three weeks later. Two *euryades* were taken above St. Ann's, and another in a wood at San Juan, but this species did not appear to have a strong scent. The rich golden-brown *Eueides aliphera aliphera*, Godart, was rather common on the Ariapeta path at about 100 ft., and appeared to be more or less gregarious in its habits; both sexes had a strong smell like stables. It is curious that the Nymphalines of the genus *Dione* have the same odour; they are also very similar in general appearance to *Eueides*.[1]

The *Nymphalinae* are very well represented in the New World, and therefore in Trinidad, but the genus *Colaenis*, which I had found so prominent in Jamaica, was during my flying visits to Trinidad met with but once, in the person of a single female, *C. julia*, Fabr.; while the nearly allied *Dione* was represented by a single male, *vanillae*. On the other hand, the more humble-looking *Phyciodes leucodesma* was abundant. Of *Synchloë lacinia*, f. *saundersi*, I captured one at San Juan. A male *Precis lavinia* was intermediate in character; at San Juan, on April 2nd, *Anartia amalthea* was common about a small swamp, but it had lost its beauty, the specimens being mostly tattered: on April 14th it was seen above St. Ann's, at an elevation of 1000 ft., in much better condition, but in that locality also it showed a partiality for water. *A. jatrophae*, common enough at the time of my first visit in January, was evidently over, a tattered male being all that I saw of it. A single specimen of *Adelphia cytherea*, Linn., occurred high up the path. The pretty little *Dynamine theseus*, Feld., was locally common at about 800 to 1000 ft.; one example had the black borders to the hind-wings broader than usual. At La Brea a specimen of *D. postverta*, Cram. (*mylitta*, Cram.), was picked np and another missed; it has a beautiful underside. The two large grey butterflies, *Peridromia feronia*, Linn., and *Ageronia ferentina*, Godart, which are as much alike as their names are confusing, both occurred in the same open flowery part of the wood on the Ariapeta path, at about 1000 ft. above sea-level — one of my favourite spots. They are alike hard to catch. The first-named settled on grey tree-trunks, looking like a large Boarmiid moth, and almost as cryptic, but always *head downwards;* they were, however, very shy and easily disturbed, though returning again and again to the same tree. I have already referred to Darwin's observations on this

[1] For Fritz Müller's views see below, Appendix, §§ IX.-XII.

butterfly.[1] It is some small consolation to me that although the great naturalist observed points that escaped my notice, he did *not* observe that the male has a treacly scent. The beautiful scarlet and black *Didonis biblis* was common enough above 300 ft. elevation, fluttering about the bushes, but many of the specimens were worn. Here, again, my deficiencies as an observer are painfully evident, for I did not detect any scent in a butterfly in which Fritz Müller found no less than three![2] While the light grey *Cystineura cana*, Erichs., occurred nearer the sea-level (*e.g.* at La Brea), it was extremely abundant up the Ariapeta path from 400 to 1200 ft. With the colouring of a Satyrine it has almost the flight of a *Neptis*. Butler's name *cowiana* would appear to have been given to a melanic specimen, but with a long series before me I quite satisfied myself that it is no "good species." The handsome green and black *Victorina stelenes* was fairly common.

In England one is apt to forget that the *Erycinidae* are an extensive family, but short as my experience in Trinidad was, I made the acquaintance of six species: of *Lemonias pseudo-crispus*, Westw., I took but one; of the small, elegant, delicate, Satyr-like creature *Mesosemia tenera*, Westw., I took two specimens in a swamp just above the reservoir at St. Ann's; at San Juan I saw four or five little butterflies dancing together in the sun, perhaps courting, but only managed to secure one of them, which proved to be *Charis argyrodines*, Bates; of *C. avius*, Cram., I saw two or three in the same swamp as the *M. tenera*. From the Pitch Lake I brought home two *Nymphidium molpe*, Hübn., both females, while near the favourite spot up the Ariapeta path I found a male of *N. lamis*, Cram., at rest on a leaf with its wings fully expanded.

The Blues were interesting: the elegant *Leptotes cassius* occurred both at St. Ann's and La Brea, being identical with specimens taken in Venezuela, but quite unlike the Jamaican *L. theonus*;[3] *Catochrysops hanno* was also met with both at La Brea and St. Ann's, but appeared to be confined to circumscribed spots; of *Polyniphe dumenilii*, three were taken at St. Ann's; two of them rejoiced in the pig-sty odour, though it was comparatively faint. One of them was a very large female, of which Mr. H. H. Druce says that the upper side of the fore-wings is more suffused than in continental specimens. It is curious that Mr. Kaye with his great experience in Trinidad, has met with only three specimens of this

[1] See above, p 264.
[2] See below, p. 501; also Appendix, §§ I., IV.
[3] See above, p. 285.

black and white Blue. *Thecla politus*, H. H. Druce,[1] was to be had in some numbers on a flowering shrub in the Botanic Garden, close to the Governor's house; of *T. badaca*, Hew., one occurred at St. Ann's; the same may be said of *T. spurius*, Feld., but in this instance the butterfly was seen sitting head downwards: the hind-wing is folded and furnished with a large lobe; *T. syncellus*, Cram., one example of this very brilliant, dark purple-blue butterfly was taken on the Ariapeta path at about 1000 ft.; *T. albata*, Feld. (*sedecia*, Hew.), one at La Brea; *T. linus*, Sulz., was rather common about the swamp near St. Ann's reservoir, also far up the path at 1000 to 1400 ft. This is a very distinct species, having a striped underside; the lobes are everted, though not quite to a right angle, and when the creature is at rest the tails are crossed representing the antennae of the false head, which indeed looks more like a head than does the real organ. [See Fig. 12.]

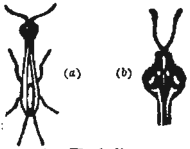


FIG. 12.—*Thecla linus* at rest.
(a) Nat. size; (b) Lobe enlarged.

Papilio polydamas, with its odour of musty straw, occurred in the Botanic Garden, and also at La Brea. I took a fine female of the beautiful *P. cymochles* (*zeuxis*) in a swamp at San Juan and a male high up the Ariapeta path, and at the latter locality got one *P. aeneides*, Esp. (*gargarus*, Hübn.); it had a musty straw odour.

Pierines were distinctly scarce, *Callidryas* appeared to be over; of *Sphaenogona gratiosa* I caught a male, also one of the same sex of *Aphrissa statira*, Cram., but this species was shy, restless, and wild, so that others escaped my clutches. *Terias albula* alone was common, and its light colour made it conspicuous; it occurred both at St. Ann's and at St. Juan.

Skippers were more numerous than Pierines, or at any rate more varied; *Thymelicus vibex*, Hübn., of the yellowest form called by Plötz *combinata*, two males at St. Ann's; *Heliopetes arsalte*, with its swift dashing flight was rather common; a small black Skipper was plentiful at San Juan, but probably I was too intent on larger game to pay much attention to it, for I caught only one, which proved to be *Staphylus mazans*, Reak. (*ascalaphus*, Stdgr.); *Cogia calchas*, H.-Schäff., turned up in the Botanic Garden, as did the handsome Fire-tail, *Pyrrhopyge venezuelae*, Scudd. Single specimens of *Eudamus catillus* at *Lantana*, another seen; *Megistias telata*, H.-Schäff.; *Cymaenes silius*, Latr., and *Perimeles remus*, Fabr., were found upon the Ariapeta Road.

[1] See below, p. 390.

The Pyrale *Mapeta xanthomelas*, Walk., took its place among the butterflies, and very conspicuous it was, being especially common among Cacao-trees just above St. Ann's Reservoir. Another Pyrale, the silver-grey *Glyphodes ausonia*, Cram., of which two occurred at the highest point attained on the Ariapeta Road, close to the spot where I took *Euptychia ebusa*, was so like that butterfly upon the wing, that the two were confounded; yet any one seeing the insects side by side in a cabinet would have said that such a thing was quite impossible.

The only other *Heterocera* met with in Trinidad were the Hawk-moths, *Pseudosphinx tetrio*, Linn., and *Dilophonota ello*, Linn., taken beneath arc-lights in the streets of Port of Spain.

I took but very few Beetles: the Longicorn, *Stirastoma depressum*, Linn., distinguished by the hardness of its exo-skeleton, was found on a tree-trunk at the good butterfly locality up the Ariapeta path, at about 1000 ft. The large orange and black Cantharid, *Horia maculata*, Sweder., and *Ligyrus tumulosus*, Burm., sought the electric lights. *Asphaera nobilitata*, Fabr., was captured when flying over the swamp near St. Ann's Reservoir. The Elaterid *Pyrophorus pellucens*, Esch., captured at night in the Belmont Circular Road, exhibited two constant green lights, powerful enough for me to read by their aid the smallest print. Under the thorax, in the crack between it and the abdomen, was a triangular area which was faintly luminous, the light having a slight reddish tinge. Chloroform at first increased the brilliance of the green lights, but they were soon eclipsed.[1]

The flowers in the Botanic Garden attracted quite a number of Bees, mostly small species: *Melipona capitata*, Smith; *M. ruficans*, Latr.; *M. amalthea*, Fabr., and *M. rufiventris*, Lepel., a foxy-coloured neatly banded species; *Melissod esrufodentata*, Smith; *Melissoptila* sp.; the common Honey-bee of the *mellifica* form. With these was the large Bombus-like, yellow-banded, *Centris flavifrons*, Fabr., and a large blue-black Pompilid.

The Wasps were represented by a very few individuals: *Polistes annularis*; *Polybia occidentalis*, Oliv., var. *oecodoma*, Sauss. At San Juan I took *Larra gastrica*, Tasch., and the very elegant black and yellow *Sceliphron figulum*, Dahl., as well as two Pompilids.

At the last-named locality I took a Bug, a species of *Zicca*, which

[1] Compare P. H. Gosse's account of *Pyrophorus noctilucus*, Linn., "A Naturalist's Sojourn in Jamaica," p. 106 *et seq.* By the kindness of Dr. F. L. J. M. de Verteuil, R.N., I was able to exhibit at the Entomological Society a number of living specimens of *P. noctilucus* from Trinidad. *Proc. Ent. Soc. Lond.*, May 1st, 1907, p. xxxii.

Mr. W. L. Distant says is structurally distinct from any species represented in the British Museum. *Oncopeltus cingulifer*, Stål, which I had also taken near Carácas, was netted flying high above St. Ann's. Lastly, the brown fetid *Dinocoris piceus*, Beauv.—a creature with an awe-inspiring name[1]—was attracted by the electric light. I have not permission to publish the details of Mrs. Longstaff's researches at the Colonial Hotel into the habits of insects of this order (alluded to above), but I have no reason to suppose that she found the dim light of candles in any way attractive, if anything the reverse.

TOBAGO.[2]

April 3rd—10th, 1907.

A glance at the map shows that this island stands outside the crescent of the Lesser Antilles, or Windward Islands, about 20 miles to the north-east of Trinidad in lat. 11° 15′ N. The southernmost of the Windward Islands proper, Grenada, is about 70 miles W.N.W. of TOBAGO. It is therefore pretty obvious that, geographically speaking, Tobago belongs to South America rather than to the West Indies. The mountains of the north-east coast of Venezuela, consisting for the most part of clay slates and schists believed to be of Silurian age, run by way of the peninsula of Paria and the islets of the Bocas, along the northern coast of Trinidad, and would appear to be prolonged to the eastern half of Tobago.

In area Tobago is about equal to the county of London, comprising but 114 square miles, and therefore only about three-fourths of the size of the Isle of Wight, and only one-fifteenth of that of its neighbour. (Trinidad, area 1754 square miles = Lancashire.) The south-western portion of the island, which is low and more or less flat, is formed of coralline limestone, and is completely cultivated. The central and north-eastern portions are hilly, rising to 2000 ft., and in large part covered with forest, some of it virgin, but much of it of second growth, or "rastrajo." The destruction of the forest is proceeding apace.

My stay was limited to eight days, three of which, thanks to the hospitality of the Hon. H. L. Thornton and Mr. G. H. Sworder were spent at their estate, "Cocoa Wattie," the remainder near the coast.

We found the neighbourhood of Scarborough, the capital, for some miles on either side of the town very dry and parched, though

[1] Pitch-black terrible bug.

[2] The greater part of this section appeared in the *Transactions of the Entomological Society of London*, 1908, pp. 53–57.

we were told that there had been some nice showers at night during March. The Trade-wind blows very strongly along the coast, a dry, hot blast which greatly increases the difficulties of the collector.

Cocoa Wattie is a plantation near the middle of the island towards the confines of cultivation, lying about 550 ft. above sea-level. The wooded banks of a small river and some swampy hollows clothed with coarse grass and thin scrub afforded the best collecting grounds, and yielded, as might have been expected, a somewhat different fauna from that of the coast. It rained heavily on April 8th.

Anosia archippus, Fabr. (*plexippus, auct. nec* Linn.). Three ♂, one ♀. Rather common in the outskirts of Scarborough; one specimen at Cocoa Wattie. My specimens resemble those from the mainland, though one Tobagan, a ♂, approached Jamaican specimens in colouring.

Euptychia hermes, Fabr. (*camerta*, Cram.). Five. Abundant at Cocoa Wattie.

Euptychia hesione, Sulz. Six. Common at Cocoa Wattie.

I have taken this species and the following flying during rain.

Heliconius hydarus hydarus, Hew. Three ♂, two ♀. Rather common on the river bank at Cocoa Wattie. All the specimens are small, three extremely so; four of them have the bluish gloss (as in the form *guarica*, Reak., though that is a larger insect) which Mr. W. J. Kaye associates with wet conditions.[1]

Precis lavinia, Cram., f. *zonalis*, Feld. Two ♂. An example taken near the coast of the "dry" form, but with the anterior ocellus on the hind-wing very small. (Mr. W. J. Kaye has two very dark specimens from Mexico in which this ocellus is altogether wanting; in the National Collection there is a specimen from Colombia in which there are no ocelli on the upper surface, and only faint indications of them beneath.) The Cocoa Wattie example is intermediate, approaching the wet-season form. Both the specimens would probably be called by Mr. Godman *coenia*, Hübn., and by West Indian entomologists *genoveva*, Cram.; but I follow Mr. G. A. K. Marshall.[2]

Anartia jatrophae, Linn. Three. On the coast, not common. Those taken are pale in colour and semi-transparent, of the mainland form.

Anartia amalthea, Linn. One at Cocoa Wattie. Messrs. Godman and Salvin[3] say of this species: "Barbados, a single specimen . . . not previously noted from any West Indian island."

[1] Compare Col. Manders and L. de Nicéville on blue-glossed *Euploea*, *Trans. Ent. Soc. Lond.*, 1911, pp. 420, 421.

[2] See above, p. 282; also Chap. X., § 13.

[3] Godman and Salvin, "Butterflies of St. Vincent, Grenada, etc.," *Proc. Zool. Soc. Lond.*, 1896, p. 515.

Dynamine theseus, Feld. This pretty little butterfly was common both on the coast and inland. It has a rapid gliding flight, but otherwise has some of the habits of a Lycaenid; thus, it often settles with its head downwards, and more than once I saw it immediately after settling move its hind-wings rapidly; the insect was, however, too shy to enable me to make out the exact nature of this movement.

Cystineura cana, Erichs. Two specimens on the coast, and two at Cocoa Wattie. It has a gliding flight.

Leptotes cassius, Cram. Two ♂, two ♀. Of the mainland form, in which white prevails over blue. Rather common along the coast; three specimens were small, but one female was larger than usual.

Catochrysops hanno, Stoll. One specimen to the east of Scarborough.

Thecla beon, Cram. Four. One specimen on the shore to the south-west of the town at the flowers of the Seaside Grape; rather common at Cocoa Wattie, frequenting the flowers of a purple Papilionaceous shrub.

Thecla politus, H. H. Druce. A ♀ at Cocoa Wattie.

Mr. H. H. Druce says that hitherto this species has been wrongly identified with *T. beon*, Cram.[1] To one of my specimens in the Hope Collection he has appended a note: "Some ♂♂ of *T. politus* have blue scales on the hind-wings above, which I have not noticed on the only ♂ I have from Santarem."

Thecla nubes, *sp. nov.*[2] One specimen at the Seaside Grape, near Hillsborough; four at Cocoa Wattie at the pink flowers of a creeper. [Plate III., Figs. 3, 4, 5.]

Callicista bubastus, Cram. (*salona*, Hübn.). One taken in Fort George, another at the flowers of the Seaside Grape, near Hillsborough on the coast.

Terias nise, Cram. Three ♂, three ♀, all of the wet-season form. Common near the coast. The male had a very strong scent like *Convolvulus arvensis*.

Terias albula, Cram. Three. Near the coast, less common than the last; one taken two miles inland on the road to Cocoa Wattie.

Pieris phileta, Fabr. (*monuste*, *auct. nec* Linn.). Two males under the coco-nut palms to the west of the town; one "wet" the other intermediate in phase.

Callidryas eubule, Linn., f. *sennae*, Linn. Abundant alike in

[1] *Proc. Zool. Soc. Lond.*, 1907, pp. 625, 626.

[2] Described by H. H. Druce, *Proc. Zool. Soc. Lond.*, 1907, p. 625. Mr. Druce received the specimens too late for figuring.

Scarborough and along the coast towards the east, tearing about in all directions, but not at all common at Cocoa Wattie. Six ♂ and four ♀ taken, of these three were of the wet-season form, seven intermediate, but all were very small. I noted that the males were attracted in numbers by the flowers of the Pineapple in the Government Botanic Station.

Phoebis agarithe, Boisd. Three ♂, one ♀. Common to the east of Scarborough; very showy on the wing, though very difficult to catch, being not merely a strong flier, but also wary and seldom remaining on a flower for more than a few seconds, moreover it seems to like exposed places in the full blast of the Trade-wind. Those taken were all small, one male remarkably so; they are moreover much paler than specimens in the Hope Collection from Barbados and Venezuela.

Eudamus catillus, Cram. One small specimen on the shore to the west of the town.

Pyrrhopyge venezuelae, Scudder. One at Cocoa Wattie.

Hesperia syrichthus, Fabr. Common on the coast; one example at Cocoa Wattie.

Callimormus corades, Feld. Three at Cocoa Wattie.

Systasea erosa, Hübn. One at Cocoa Wattie. In this species the fore-wings are remarkably convex.

Epeus veleda, Godm. & S. One at Cocoa Wattie.

Megistias cortica, Plötz (*epiberus*, Mabille). One at Cocoa Wattie.

Cymaenes silius, Latr. One at Cocoa Wattie. This species rests with the wings in the same position as our *Pamphila thaumas* and *P. sylvanus*.

Of the twenty-eight species in this list, twenty-four[1] are known to Mr. Kaye as occurring in Trinidad; those not met with in both islands being *Phoebis agarithe*, *Thecla nubes*, *Epeus veleda* and *Callimormus corades*. None of these is recorded by Messrs. Godman and Salvin from the Lesser Antilles.

As regards the general abundance of Butterflies, Tobago occupies a position between Jamaica and Trinidad. Whereas eight days' collecting in Tobago yielded 28 species, seven days' in Trinidad yielded 61; but it took ten weeks to get together 47 species in Jamaica. On the other hand, Venezuela proved much richer than any of these islands, for 135 species were collected in fifteen days.

In addition to the above I saw on the wing, about a mile from Cocoa Wattie, *Caligo* sp.; also Mr. Sworder gave me specimens of

[1] Of these twenty-four at least nineteen also occur in Venezuela.

Ithomia pellucida, Weym., and *Pteronymia asopo*, Feld., which he had taken at Cocoa Wattie, and he showed me specimens of other butterflies which I did not happen upon alive, including *Morpho* sp. The Hope Collection has *Terias westwoodii*, Boisd., from Tobago. Neither the last-named nor *P. asopo* have as yet been recorded from Trinidad.

The following moths were taken :—

Utetheisa ornatrix, Linn., locally abundant about Scarborough, more especially in what remains of Fort George; some of the specimens had a peculiar somewhat musty odour during life. Except a single *Pionea taeniolalis*, Guen., which was kicked up from herbage, all my other moths were victims of the fatal attractions of light. These included the Syntomid, *Eucereon maia*, Druce; an Arctiid, a species of *Virbia*; a specimen of *Poaphila immunis*, Guen., resembled British Museum specimens from Venezuela, rather than the familiar West Indian Noctuid; the lines are different, and, if it is not a distinct species, it would appear to form a well-marked local race; our pretty Jamaican friend, *Cydosia histrio*, turned up again; the Quadrifid *Pleonectyptera paucula*, Walk., is a small reddish-grey Geometer-like moth; then the Deltoid, *Tortricodes orneodalis*, was an old acquaintance. The Geometers were represented by the reddish *Anisodes metaspilata*, Walk., and the bright green *Tachyphyle* (*Dichorda*) *iris*, Butl.

The commonest Pyrale was perhaps the ochreous, dark-bordered *Nacoleia ebulealis*, Guen.; then there were *Diatraea saccharalis*, Fabr., *Azochis gripusalis*, Walk., and the Chrysaugine, *Tosale oviplagalis*, Walk.

Parasol-ants were extremely destructive to Mr. Thornton's young cacao plants, attacking them when they had but few leaves and none to spare. Vigorous efforts to destroy the nests met with but indifferent success. M. Forel has determined the species to be *Atta cephalotes*, Linn., var. *polita*, Smith. The black *Odontomachus haematodes*, which was to be found under dead leaves, etc., both bites and stings severely, but the effect fortunately passes off in a few minutes.

Near the shore to the east of Scarborough the blossoms of the Seaside Grape (*Coccoloba uvifera*, Jacq., Nat. Ord. *Polygoneae*) were very attractive to Bees and Lycaenids, the most numerous visitors being several species of *Melipona*, among which *M. amalthea*, Fabr., and *M. favosa*, Fabr., contended on almost equal terms for the first place, but another unnamed *Melipona* is surely the tiniest of all bees. Lastly there was an undetermined *Augochlora*. With the bees were

a Sphex, and a Wasp, *Notogonia* sp., and *Polybia occidentalis*, Oliv. The big *Xylocopa aeneipennis*, De Geer, as might have been expected, preferred a larger and more gaudy flower, and accordingly haunted the purple blossom of a Papilionaceous shrub. At Cocoa Wattie I captured a small black Pompilid, *Salius* (*Hemisalius*) *opacifrons*, Fox.

In a ditch some two miles to the east of Scarborough I found a specimen of *Uroxys* which is not to be matched by any in the British Museum. At Cocoa Wattie I took a *Photinus*, to which Mr. Gahan cannot assign a name, and a *Diabrotica*, which he considers new. Mr. Sworder found in a tank a male *Phengodes pulchellus*, Gerht., which exhibited a green light from the under surface of the middle of the abdomen; the light was constant, but appeared to be under the control of the insect. He also, when out with me, dug out of rotten wood the abundant New World beetle, *Scalmus* (*Ninus*) *interstitialis*; the specimens were small, one of them remarkably so. In contrast with the last he took in the same surroundings *Passalus interruptus*, Linn., a very large insect of which I afterwards found a dead specimen at the foot of the lighthouse in Fort George. A Dynastid beetle came to light at Cocoa Wattie, which may be a form of *Aegopsis trinidadensis*, Sternb., but does not agree exactly either with that species or with *A. curvicornis*, Westw. Several Coreid bugs, *Jadera aeola*, Dall., came to the lamp. That evening Mr. Sworder easily convinced me of the advantage of placing the attracting lamp on a white sheet; many insects that would otherwise probably escape are quite conspicuous on the sheet.

When homeward bound we made our first acquaintance with the Sargasso, or Gulf-weed. Like many other things of which much has been heard, it hardly came up to expectations. For a day or two we saw quite small patches at long intervals, then larger masses, but at its best there was nothing that the most scientific, or even the most unscientific imagination could picture as affording lurking places for such fearsome monsters as we know by the old charts were commonplace to the Elizabethan sea-dogs. Yet its colour is brilliant and looks all the more so by contrast with the blue sea. A quarter-master constructed for me a small grapnel out of stout wire, with which I proceeded to fish. I made many and many a cast, and was surprised at the difficulty of catching any weed, and the still greater difficulty of bringing it to deck. When a ship is going at even such a moderate pace as 13 or 14 knots, fishing is by no means easy, and the sea seems at the last moment to snatch from the

grapnel anything that it may have hooked. However, I secured a piece on April 21st in Lat. 29° N., Long. 40° W., and a second sample some 22 hours later, say about 300 miles from the first. The weed when in the hand is pretty, and quite unlike any Alga found in British seas. Kingsley's figure gives a good idea of it.[1] This is what he says of the results of his examination: "A tiny curled Spirorbis, a Lepraria with its thousand-fold cells, and a tiny polype belonging to the Campanularias, with a creeping stem, which sends up here and there a yellow-stalked bell, were all the parasites we saw." So wrote Charles Kingsley of the results of his fishing on December 17th, 1869. Careful examination with a pocket lens of the fronds at my disposal revealed three organisms, and three only; these three organisms were present in both my samples, and moreover would appear to be the same that Kingsley found. It surely indicates a very remarkable similarity of conditions extending far in both time and space.

[1] "At Last!" 1882, pp. 8-11, with figure

CHAPTER VII.

CEYLON, 1908.

Latitude of the extreme points visited, 9° 27′ N. and 7° 24′ N.

January 7th—March 16th.

MY fortnight in the great Crown Colony in 1904 was so delightful that I was glad to seize an opportunity for making its more intimate acquaintance.

Among the passengers on the R.M.S. "Orotava" was Mr. Seth Smith, F.Z.S., who was on his way to Australia to obtain living specimens of mammals and birds for the Zoological Gardens. At Port Said we had a pleasant walk for some distance along the Sweet-Water canal, where Mr. Seth Smith saw many more birds than I did insects. Three days afterwards (December 29th), the sea being smooth, the wind light and variable, the captain brought me a large Locust which had just settled upon the bridge. The ship was about 70 miles from land, off Mecca. The captain told me, and I am disposed to agree with him, that the white paint on the upper works of the ship appeared to attract insects. Mr. Seth Smith saw a Red Locust the next day.[1]

On Sunday, January 5th, we passed close to Minikoi Island, an outlying atoll of the Laccadives. It is the only specimen of the class that I have seen and the desire to land upon it was naturally strong. Two little boys on the ship who had just been reading the charming book of that name thought that Minikoi was "*The* Coral Island." We tried to think that we could smell Ceylon from an immense distance: the aroma is supposed to be that of cinnamon, but the element of imagination loomed large.

[1] *Schistocerca peregrina*, Oliv. Owing to the unfortunate confusion of nomenclature the "locusts" of ordinary parlance, having short antennae, are included in the *Acridiidae*, or Grasshoppers, and have nothing to do with the long-horned *Locustidae*.

Mount Lavinia.

January 7th—12th, 1908.

Mount Lavinia, a mass of rock breaking the even line of the sandy shore a few miles south of Colombo, has a charm all its own. Far away to north and south the waving coco-nut palms fringe the golden sands which are the resort of fishermen innumerable. These are an amphibious race who boldly face the roaring surf in their catamarans, strange "dug-out" craft with picturesque brown sails, craft that are the very embodiment of safety till the fatal moment when the out-rigger giving way causes disaster as promptly as when the engine of an aeroplane strikes work, with, however, the important difference that the amphibious fisherman has no fall but simply rolls over into his other element.

The Crow [1] throughout the east is familiar, but nowhere more so than at Colombo, where the hotel-keepers find it advisable to put up notices warning their guests of its habit of stealing such trifles as rings, eyeglasses, or even necklaces. At Mount Lavinia crows used to come into our room at the hour of chhota *háziri*; [2] and we were told that not long before one had succeeded in carrying off an egg-cup! A lady, a Colombo resident, told us the following story of her personal experience. She was the owner of a tiny fat puppy that could hardly stand. Once, when lapping milk from a saucer it was attacked by two crows front and rear. One seized the puppy by the tail and dragged it backwards, holding it while its mate tackled the milk. When, however, the latter had drunk its fill the selfish bird went off, declining to take its turn at tail-pulling.

The few days spent on the coast, though not very profitable as regards the collection of butterflies made, were of interest as a basis for comparison. Thus, in five days' work on the coast I took 104 specimens, whereas a like time at Kandy produced 106 specimens, no great difference truly, but the coast collection included only 26 species, the inland collection 43; of these, 16 species were common to both lists. There was but one butterfly taken by me on the West Coast, which I did not, sooner or later, meet with at Kandy, viz.:—*Zizera lysimon*, Hübn. f. *karsandra*,[3] Moore, of which I took two at

[1] The Indian Grey-necked Crow, *Corvus splendens*; an amusing account of its familiarities is given in "Cassell's Natural History," vol. iv. pp. 11–13.

[2] Literally "Little breakfast." Early tea.

[3] In this chapter I have endeavoured to follow the nomenclature of later authorities (Bingham and Hampson), but have usually given in brackets the name under which the species will be found in Moore's "Lepidoptera of Ceylon."

Mount Lavinia and one at Fort Frederick, Trinkomali, on the East Coast; it would appear to be a lowland species.

The actual coast was too exposed to the prevailing wind to be of much good as a collecting ground, and the Cinnamon Garden proved somewhat disappointing. Naturally enough my attention was first drawn to the Papilios which were obvious and not uncommon. The yellow tail-less *P. demoleus*, Esp. (*erithonius*, Cram.), which had been such a familiar object in Northern India, was to be seen flying swiftly about in exposed spots close to the sea, as well as in the Cinnamon Garden. When feeding on flowers it flutters its wings, not stopping long on any one flower. A female exhibited a slight peculiar scent in the field, which was stronger in the house. Then there was another old friend, *Papilio aristolochiae*, Fabr., curiously shaped out of crêpe and studded with rubies; it had a hay-like scent, sometimes musty, sometimes sweeter, and it was hard to kill. Two or three *P. pammon*, Linn., were seen. The gorgeous red, black, and white, *P. hector*, Linn., than which I have seen few handsomer butterflies, occurred somewhat commonly in the Cinnamon Gardens; my specimens were netted in the near neighbourhood of *Lantana* bushes, though not actually taken on the flowers. Like the last-named species this was tenacious of life, and its male had a musty odour. *Hector* flies straight along, sometimes high, but not very swiftly. The movement of its wings, rendered more obvious by the strong contrast of colours, appears to be rotatory. My friend Commander J. J. Walker, R.N., M.A., has recently called my attention to the flight of our little black and white Pyrale *Ennychia octomaculalis*, Fabr., as appearing to "spin" on the wing. Something of the same sort struck me in the flight of the beautiful Peach Moth of South Africa, *Egybolia vaillantina*, Stoll, a steel-blue and orange-yellow Catocaline Noctua.[1] In all these cases I think that the apparently excessive movement of the wings in a rotatory manner is due to an optical illusion caused by the sharply contrasted colours of the insects.

It was at Mount Lavinia that I first had the pleasure of catching the black and green *P. agamemnon*, Linn., a butterfly that I had seen twice before. They were in poor condition, flying rapidly, often quite close to the sea, where the only flower under the palms was the Periwinkle of the tropics, *Vinca rosea*, Linn., a plant but little attractive to insects. One specimen appeared to have a very slight sweet scent. Besides these I saw several of the magnificent, great black and yellow *Ornithoptera darsius*, Gray, and one afternoon

[1] See above, p. 195.

secured a fine specimen of each sex fluttering on the flowers of *Clerodendron infortunatum*, Linn., a plant called by the Sinhalese Gas-pinna. This most aristocratic butterfly, which has all the magnifical air of a Kandyan Chief, is peculiar to Ceylon. The male had a slight spicy scent, the female a slight disagreeable one.

The little brilliant yellow *Terias hecabe*, Linn., was by far the commonest Pierine, being especially numerous near the sea. It has a jerky flight, close to the ground; when disturbed after 4 p.m. it settles again almost at once. Of the twenty specimens taken on the West Coast no less than fifteen (11 ♂, 4 ♀) were of the wet-season form, as against two (one of each sex) that were of the dry-season form; three (2 ♂, 1 ♀) were intermediate in character. Next in order of abundance was *Catopsilia pyranthe*, Linn., of which indeed I saw far more here than in any place. The males undoubtedly have a sweet scent, which may be compared to that of *Stephanotis*. In one female a similar scent was noted, but in two others it is described simply as "sweet," with the qualification (when submitted to Mrs. Longstaff) "a little bit hair-oily." Of *C. pomona*, Fabr., I took but one at Mt. Lavinia, a very large female of the typical form, and noted of it: "flies faster than *pyranthe*; had a very slight sweet scent, both alive and after death."

From the imperfectly expressed statements of several natives I gathered that we had just missed one of those butterfly flights for which Ceylon is famous; it had occurred at about Christmas, but would seem not to have been of the first order of magnitude.

The somewhat gaudy *Delias eucharis*, Drury, was not common. The only other Pierine observed was a solitary *Nychitona xiphia*, Fabr.

Of the Blues I saw several kinds, the prevailing genus was *Castalius*, the commonest species *rosimon*, Fabr., which was, however, confined to the Cinnamon Garden; two specimens were observed at rest, with their wings closed and their tail towards the sun. Of *C. ethion*, Dbl. & H., an insect that I had not taken before, I secured one example. Of *Lampides celeno*, Cram., so abundant at Kandy, I took but one; of *Zizera lysimon* I got two. Of *Everes parrhasius*, Fabr., I took two females in the Cinnamon Gardens; both were settled with their heads downwards, and both were moving their hind-wings in the manner peculiar to Lycaenids.[1] *Talicada nyseus*, Guér., was common near the railway station; a specimen was watched moving its hind-wings.

Of the Satyrines I met with but one species on the coast, the pretty *Yphthima ceylonica*, Hew. Bingham considered this to be a

[1] See above, p. 104, also Chap. X., § 10.

race of *Y. hübneri*, Kirby. Its white hind-wings make it, superficially at any rate, the most distinct species in the genus. So far as my authorities tell me, the typical *hübneri* is not found in Ceylon. At Kallár, in the Nilgiris, in 1904, I took both forms. At Mt. Lavinia *ceylonica* was abundant, especially in the Cinnamon Garden, flying close to the ground, its white hind-wings being very conspicuous; it settled with wings half opened and with tail to the sun.

It was rather a surprise to find Nymphalines so scarce, there were not many species, and none of them were common. A few *Precis atlites*, Linn., represented a genus that is generally much in evidence. Two or three *Atella phalantha*, Drury, occurred near the hotel, a few *Neptis varmona*, Moore, in the Cinnamon Garden. *Elymnias fraterna*, Butl. (which Bingham considered to be an insular race of *E. undularis*, Drury), was rather common; it often flies *in* bushes, or, if not, close to the ground. I noted that at 4 p.m. it was hard to make the insect fly clear of cover, so that it was aggravatingly difficult to catch. The male has a decided odour of vanilla-scented chocolate, but my wife compared it to "very strong honey, or coarse brown sugar." Two *Telchinia violae*, Fabr., one of each sex, were captured.

The commonest of the Danaines was *Crastia asela*, Moore, which was regarded by Bingham, I think rightly, as a race of *core*, Cram. Its slow heavy flight was noted. Both sexes had the strong acetylene-like odour, especially perceptible in the field, sometimes marked when fluttering in the net. The impression produced was that the scent was associated with the protruded caudal tufts; the yellow juice expressed on pinching was tasteless. *Parantica aglea*, Cram. (*ceylanica*, Feld.), was almost as common as the last; both had a quite feline tenacity of life, and both had a similar scent—a scent common to both sexes; both species have a heavy flight.

Considering that Skippers were so numerous at Kandy it is remarkable that at Mt. Lavinia I took but one example of the group, a female *Parnara mathias*, Fabr.

An expedition by rail to Kalutara (also on the coast, but some 20 miles south of Mt. Lavinia) produced many of the above-named insects, but only one fresh species, *Tirumala septentrionis*, Butl., which seemed to take the place of *Parantica aglea*. Like the other Danaines, *septentrionis* appeared to have many lives, but, unlike them, the male had a rather pleasant scent, a scent which appeared to have no connection with the pouches on the hind-wings. Subsequent observations at Haragama confirmed the existence of this scent in the male, which I sometimes compared with that of Clover. But in one instance it is noted of a *female*: "Slight *Stephanotis* scent in the

field, very slight at home." Speaking of the same individual Mrs. Longstaff said: "Slight (?) ginger."

The lights of the hotel attracted the following moths: the Geometer *Dirades theclata*, Guen., and the Crambids *Schoenobius adjurellus*, Walk., and *bipunctifer*, Walk.; also the Chafer *Schizonycha ruficollis*, Fabr., and another beetle, *Coptodera* sp.

Two specimens of the Arctiid, *Amsacta lineola*,[1] Fabr. (one of them crippled) were found by Mrs. Longstaff on rocks close to the sea.

The pale-banded *Vespa cincta*, Fabr., made its *début* at Mt. Lavinia. It is an insect with which I became very familiar later on; the Ceylon specimens are smaller and paler than those found in India.

A female of the Carpenter-bee, *Xylocopa fenestrata*, Fabr., occurred on the shore, as well as the very large, violet-black *X. tenuiscapa*, Westw.; the Honey-bee of the country appeared to be *Apis indica*, Fabr. A spotted-winged *Dacus* was the only Fly that interested me sufficiently to involve its capture.

The red, black-spotted, Lygaeid bug, *Dysdercus cingulatus*, Fabr., was netted when flying along a road; another Lygaeid, large, black with scarlet margins, *Melamphaeus fulvo-marginatus*, Dohrn,[2] occurred in the Cinnamon Gardens; a less brilliant member of the same family, *Aphanus sordidus*, Fabr., was found under bricks. The phytophagous Beetle, *Hoplosoma ceylonensis*, Jac., might be taken either on the wing or by sweeping. *Idaethina orientalis*, Nietn., was to be found in the flowers of a species of Convolvulus in the Cinnamon Gardens, also at Kalutara in the enormous yellow and maroon-coloured flowers of a *Thespesia*. A number of the dull *Opatrum contrahens*, Walk., were found under a log on the shore. At Kalutara I also took the cosmopolitan Pyrale *Zinckenia fascialis*, Cram., and the Lamellicorn beetle *Singhala hindu*, Heller.

A few as yet unnamed Dragon-flies and Acridians close the list.

KANDY, 1500 ft.

January 14th—March 2nd, 1908.

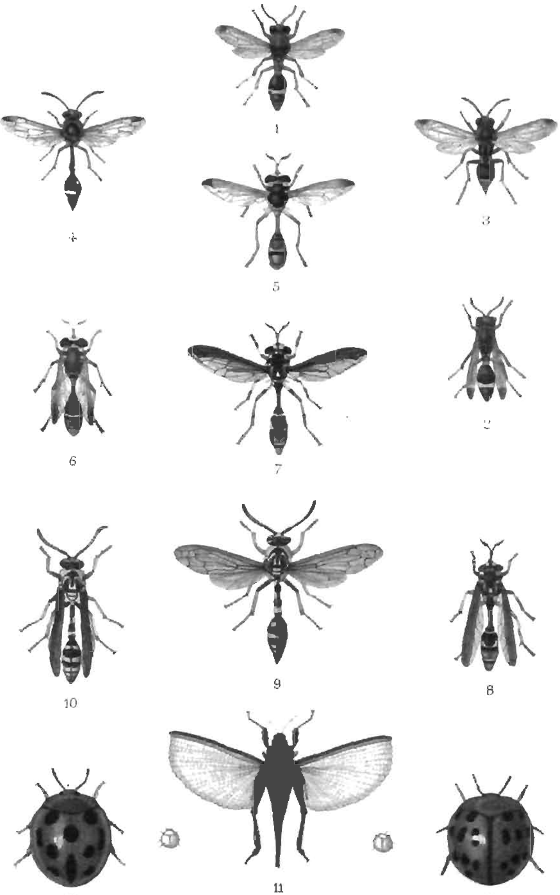
The train in its beautiful climb from Colombo to KANDY certainly takes the traveller into a more agreeable climate; though sometimes, may be, a bit steamy, the temperature was but 75° F., as against 82° F.

[1] Moore calls this *Creatonotus emittens*, Walk., so does Hampson in his "Moths of India," but in his "Lepidoptera Phalaenae," vol. iii., p. 324, he gives it the Fabrician name. My specimens were of the southern form, *Aloa flora*, Swinhoe.

[2] Probably named from a specimen in which scarlet had faded to fulvous.

Plate IV.

INDIA — CEYLON



H. and Edgar S. Knight del. West, Newman Chromo.

1. *ICARIA FERRUGINEA.*
2. THE SAME AT REST.
3. POLISTES STIGMA.
4. EUMENES EDWARDSII.
5. CERIOIDES EUMENOIDES.
6. THE SAME AT REST.
7. *CERIOIDES, sp. nov.*
8. THE SAME AT REST.
9. EUMENES FLAVOPICTUS.
10. THE SAME AT REST.
11. SCELIMENA LOGANI.
12. DERISPIA INTERRUMPENS.
13. DERISPIA COCCINELLOIDES.

on the coast; after a "cold" night the early morning temperature several times fell to 65° F., once even to 62° F.

Our hotel stood in its own garden over-shadowed by palms of various kinds. The air was filled with the ceaseless chirrupping of grasshoppers, crickets, and cicadas. The Barbets, commonly called Copper-smiths, plied their trade assiduously, and though sometimes their "tonk, tonk, tonk," rather got upon the nerves, it was withal a cheerful note.

In the dead of night now and again the Jackals' cry was heard, but they never came very near. We did not see many Mammals. Once indeed a Mongoose and once a Hare crossed my path, while three-striped Squirrels were fairly common. Once at dusk I saw a large flock of Flying-foxes coming up from the direction of Peradeniya, where they are especially common; evidently they were journeying forth in search of their evening meal, just at the time that in England Rooks would have been seen returning home. The Flying-fox is a gregarious animal, large numbers may be seen by day hanging up together in one tree. One Sunday a large Bat flew about the chancel during Matins.

Snakes were fairly common, though I saw no Cobras. One evening in the garden, close to our room, I nearly stepped upon a small thin species, but it was too dark to distinguish its markings. Some boys killed a thin whip-like Snake in Lady Macarthy's Drive; it was at least 4 feet long, destitute of any special markings; though it had a suspicious-looking triangular head placed upon a slender neck, I failed to find any fangs. That same day I saw some other boys stoning a Snake which was swimming in a shallow part of the lake. This one was about 3 feet long, somewhat thickly made, and had a line of very sharply marked diamonds down its back. As it got away through a sluice I was unable to examine it more closely, but it was decidedly a handsome beast. Mr. E. E. Green writes that judging from my description this was almost certainly *Tropidonotus piscator*, which has a very Viperine appearance, and is so pugnacious that it will deliberately strike at a stick held near it. Twice I came across Rat-snakes, rather slender, some 6 feet long, of a reddish-brown colour. They are harmless, and are said to enter houses in pursuit of rats.

Lizards were very numerous both at Mt. Lavinia and Kandy. The most notable is a species of *Calotes*, which has the power of changing colour far more rapidly than a Chamaeleon. For instance, I saw one lying in the road at Kalutara, it was then of a grey-brown tint: I succeeded in popping my green net over it, lo! it was

forthwith green. Unfortunately, however, it was too active for me and got away. A much less active, less timid, and indeed almost domesticated reptile is the Gecko; a pale, anaemic, uncanny-looking creature which clings to walls by the suckers on its feet. The Gecko is wont to take up its position behind a picture hanging near a lamp, issuing forth as soon as the house is lighted up to make its late dinner off the unsuspecting visitors to the light. In our hotel at Kandy the head of a Gecko might be seen nightly just projecting from behind a time-table that was pinned upon the wall. The only insect that I actually ever saw one of these animals eat was a small Homopteron, but I would not like to trust a rare moth to their powers of self-restraint.[1]

This reminds me that one night crowds of winged Termites came to the lights, and I noticed the hotel dog devouring them eagerly. A resident told me that both dogs and cats are extremely fond of Termites.

Once only did I see a Chamaeleon in Ceylon, a large one which surprised me by its activity.

The exterior of the Temple of the Tooth is undoubtedly very picturesque; it would be hard to say the same of the interior, which is disappointing. The so-called Tooth would defy the classificatory powers of a Cuvier or an Owen, and it would be a full size for the biggest effigy of Buddha at Dambulla. As for the yellow-robed priests, they, like their temple, are unquestionably picturesque, and many of the younger men are distinctly good-looking, but the older men—with one or two notable exceptions—have a most sinister cast of countenance. The Buddhism of the "Light of Asia," and Buddhism as actually practised in Ceylon are two very different things; it is strange to be told that Mrs. Besant, Colonel Olcott, and the other Esoteric Buddhists, whose message has fallen upon deaf ears in the West, have caused quite a revival of Buddhism in Ceylon. If this had had a purifying or ennobling influence it might have been well, but the most obvious result is an increased bitter opposition to Christianity on the part of the priests.

Some of the Kandyan Chiefs, as the native landed gentry are

[1] An interesting British parallel to this appeared recently:—"Two enthusiastic entomological friends, Messrs. A. Graveson and T. Smith . . . one night (in August, 1910) reported seeing quite a number of toads sitting boldly on the heather-tops, obviously waiting for the supper which the winged visitors should provide—no wonder some species are becoming scarcer." This would appear to have been in the Kendal district, and is recorded by Mr. Frank Littlewood in the *Entomologist*, 1911, p. 73.

called, are strikingly handsome. They have long pedigrees, but it is suggested that their undoubted European features may be due to Portuguese or Dutch blood. Some of their boys whom I saw at Trinity College were simply beautiful; they are mostly brown, but one almost black boy might have been a model to Murillo for the youthful St. John.

Kandy is the scene of an interesting experiment. All the sons of the Kandyan Chiefs go to Trinity College, which is said to be the best secondary school in the island. Here for some time the aristocracy of the Sinhalese youth has been subjected to European influences. Hitherto, however, it has been found that when the boys left school they married girls brought up under the old régime, so that much of the good that had been gained was lost. Of late years a girls' school has been started—like Trinity College under the auspices of the Church Missionary Society—and now all the daughters of the Chiefs are brought up under similar conditions to their brothers. As there is no one else for the boys to marry than these girls great results are naturally expected. At both schools the idea is to train the children in Sinhalese, and to preserve all manners and customs which are not actually vicious. It may interest my readers to know that Sinhalese boys have much greater aptitude for cricket than English boys, though it is difficult to make them take much trouble about it. A pure Sinhalese Anglican priest at Kandy is a master of English, a good reader, and an excellent preacher, short, precise, and knowing when to stop. They say that when he gives a Shakespeare reading the room is crammed.

There may be more deadly things in the forest at Kandy, but the most deadly thing that I came across was the Rattan-palm (*Calamus* sp.); it lets fall long graceful trailers, which Dr. Willis of Peradeniya will tell you are used by the plant for climbing. You are of course at liberty to believe him if you like, but I assure you that these trailing stems are perfectly adapted for quite another purpose, to wit, to catch the topi, clothes, and more especially the net of any unwary entomologist who may venture within their reach. These pliant, whip-like, fishing lines are beset with recurved prickles placed in sets of three at every inch throughout their length. You will see at the Temple of the Tooth how, in accordance with a latter-day development of doctrine, the Buddhist priests have improved upon mediaeval representations of the *inferno* by ghastly pictures of naked sinners stuck upon Rattan-palms.

The fine Snail, *Acavus grevillei*, Pfr., was common on the trunks of various palms behind the hotel. The native lads soon grasped

the idea of hunting for snails for Mrs. Longstaff, and one morning early when we first opened our eyes we saw, a few paces from our open window, a native lad in the lightest of clothing, who had probably been squatting there for hours waiting for us to wake. The moment that we showed signs of life he rose to his feet, salaamed, and proceeded to exhibit his shells.

On the leaves of Palmyra Palms (*Borassus flabelliformis*) in the hotel garden Mrs. Longstaff found a number of minute Snails, which Col. H. H. Godwin-Austen, F.R.S., has described as *Pupisoma longstaffi, sp. nov.*[1] The same mollusc occurred at Anuradhapura in like situation.

It is one of the recognized sights of the place to see the Elephants of one of the Kandyan Chiefs bathe at Katugastota. The water of the river is shallow and the animals lie down in it, but if one of them should roll over on its side there is sufficient depth of water to cover its mouth, and the nostrils of any other animal; this, however, causes the elephant no inconvenience, for it keeps the end of its trunk above the surface, suggesting the periscope of a submarine, though not homologous with that organ. It is not necessary, it is not even advisable, to give the mahout a Rs. 5 note for putting his elephant through its tricks, as I actually saw an American tourist do.

There is no question that Kandy is a very fine entomological locality, but it has the disadvantage of being very well known. Of *Tirumala septentrionis* but two specimens turned up, and it must be assumed that it is not common, at all events at that time of year. It is even more remarkable that no *Danaida chrysippus* were taken, although I have a note of having seen one out of reach on January 25th. Neither was *D. plexippus* taken, though I saw two or three in Peradeniya gardens on January 18th. In marked contrast with these, *Parantica aglea* was abundant at Kandy. There is not the slightest doubt that in this species the scent is common to both sexes, but in most cases it was not to be detected in the house, although many of the specimens were still alive. In one specimen the scent was noted as "acetylene + cockroach," in another as "in the field, acetylene + cockroach; at home, cockroach only"; in yet another the scent was noted as "not so pungent as in *C. asela*." The flight of *aglea* is remarkably slow, and often has a peculiar dancing character, especially in the afternoon.[2]

[1] "Land and Fresh-water Molluscs of India, etc.," vol. ii., Part xi., March, 1910, pp. 303, 304, and Plate cxxxii., Figs. 3, 3a, 3b.

[2] See above, p. 110.

Crastia asela was quite one of the commonest species, and I devoted some little time to the study of its scent. The results of my observations are not all quite concordant, but one thing is proved beyond a doubt, viz. that the scent is not peculiar to either sex, though it was not observed in every individual examined. My general impression is that the scent was strongest in the female. The scent is usually described in my notes as resembling that of acetylene, but in some specimens, mostly females, it had a very pungent character compared to that of acetic acid as in the Whip Scorpion, *Thelyphonus*. In one instance the pungent odour adhered to the fingers after pinching the insect. It is notable that in the same specimen the yellow juice was found to be tasteless, or nearly so. I appear to have examined the juice in five specimens; in two males it is noted as tasteless; in one male as "? slightly bitter"; in two females as nearly tasteless. Though these butterflies were tenacious of life and were often found to be alive when the papers were opened for examination in the house, a large proportion proved to be scentless, whence I infer that the scent is more volatilo than in Pierines. At first I was under the impression that the scent was evolved by the peculiar anal tufts of the male, but I was able to negative this idea entirely. (1) The scent is even stronger in the female than in the male. (2) The tufts were often protruded without any emission of scent. (3) In eight specimens the abdomen was amputated, but in no instance could any scent be connected with the severed body; on the other hand, the scent seemed to come from the base of the wings, or possibly from the thorax. Though in no instance resembling that of *Pademma*, the brand of the male varies much in size, in one specimen it was obsolescent. This, be it remembered, is not a mere colour variation, for the brand is a definite structure.

Authorities seem to be agreed that *Pademma sinhala*, Moore, is the Ceylon race of the Indian *kollari*, Feld. It is extremely like *Crastia asela*, differing chiefly in the brand of the male; both my specimens, males, appear to have been captured under the impression that they were tbe commoner species. Both specimens were tenacious of life, both had the acetylene odour in the field; one of them had no scent in the house, but on pinching it a second time, the tufts were protruded and there was a momentary strong acetylene scent. I found the yellow juice tasteless.

Of *Narmada montana*, Feld., which is perhaps the Ceylon race of *coreta*, Godart (*coreoides*, Moore), I took four males at Kandy. One or two of these were recognized during flight,[1] though very like

[1] So also Col. N. Manders, *Proc. Zool. Soc. Lond.*, 1911, p. 703.

Crastia asela. This species also proved tenacious of life; its scent resembled that of *C. asela*, but was perhaps sweeter.

It is noteworthy of these Danaines that an individual of *N. montana* had suffered a symmetrical injury to the fore-wings, while a specimen of *C. asela* had lost nearly all the hind-margin of one fore-wing and the adjoining portion of the hind-wing—an injury suggestive of a Lizard's bite.

Of the Satyrines *Orsotriaena mandata*, Moore (regarded by Bingham as a race of *O. meda*, Fabr.), was very local and only found commonly along the edge of a paddy field beyond Lewelle Ford. Those taken were of the wet-season form.

Of *Mycalesis mineus*, Linn., f. *polydecta*, Cram., I got a solitary male. The pretty little *Nissanga patnia*, Moore, a butterfly peculiar to Ceylon, was abundant, especially about Lady Horton's Drive. Twice I suspected that it had a scent, though it cannot have been strong. This butterfly sometimes settled with its wings expanded, but more usually they were closed though, so far as I saw, the eye-spots were always exposed to view. It was somewhat careless as to orientation.

Yphthima ceylonica was very abundant, the males appeared to have a very slight scent suggestive of chocolate. It usually settled with its wings half open and with its tail to the sun, and was once seen to adjust itself to that position. A female had the underside of a yellowish colour, in place of the usual grey; a (?) male had a small symmetrical injury to both fore-wings, which might have been inflicted by a bird.

Of *Melanitis ismene*, Cram. (*leda*, Drury, *nec* Linn.), I took but four at Kandy; two of these, one of each sex, both dry-season specimens, were taken flying at 9 a.m.; a male, intermediate, inclining to "wet," was, on the other hand, taken at dusk; others were seen when it was so nearly dark that I could not catch them. One evening when strolling in the garden in search of this species a leaf of a Coco-nut Palm fell close to me with a positive crash; when one considers that it measured between 11 and 12 feet it can be understood that I was not a little startled. Of *Elymnias fraterna* I saw but two, one of which—a worn female—I took for a battered *Danaida chrysippus*.

The great sub-family of the Nymphalines is very much to the fore at Kandy. On my second day out I came across a male of *Apatura* (*Rohana*) *camiba*, Moore, settled on the upper side of a leaf with wings expanded, but never saw another; this Col. Bingham considered to be a southern race of *parisatis*, Westw. Of *Euthalia* (*Adolias*) *vasanta*, Moore, I also found a single example, it was resting on the ground in a damp ditch with wings fully expanded. I had not the good fortune

to capture *Parthenos cyaneus*, Moore, one of Ceylon's finest butterflies, but more than once was grievously tantalized by watching its remarkable flight. It is a large and very striking insect of a beautiful greyish-blue colour: in marked contrast with *Papilio parinda*, which flies with much seemingly laborious flapping, though its wings do not appear to be depressed below the horizontal position, the *Parthenos* glides about, at every two or three yards strongly depressing its wings with a jerk, but seldom appearing to raise them much above the horizontal. One day I had the misery of studying this movement for the best part of an hour as the lordly insects sailed about far above me. That accurate observer Mr. E. E. Green agrees with my description of its movements. After I left Kandy Mr. E. F. S. Tylecote succeeded in capturing one or two specimens of *cyaneus*; but I had previously had ample opportunity of observing how an entomologist might be helped on occasion by much practice in dealing with swift bowling.

The commonest *Neptis* at Kandy is the species generally known as *varmona*, Moore, which however Bingham regarded as indistinguishable from *eurynome*, Westw. It has the floating flight so characteristic of the group; when it settles the wings usually remain expanded, but not always; it appears to be for the most part indifferent to its position with regard to the sun. *Neptis jumba*, Moore, was comparatively scarce, it is quite a distinct species in which, when alive, the white markings have a distinctly blue tinge. In two males I thought I detected a faint scent, like chocolate, or perhaps vanilla. *Rahinda sinuata*, Moore, regarded by Bingham as a race of *hordonia*, Stoll, was rather common, its resting habits are similar to those of *Neptis*.

The great tropical and sub-tropical genus *Precis*, called by many authors *Junonia*, was well represented by five out of the six Indian species, but of *P. lemonias*, Linn., one only, of *P. orithyia*, Linn., two only, of *P. atlites*, Linn., three only, and of *P. almana*, Linn., three only were seen, the latter being of the "wet" form, *asterie*, Linn. On the other hand, *P. iphita*, Cram., was often abundant. Out of twenty-one specimens brought home, mostly in poor condition, three only, all males, had the sub-costal white spots on the under-side of the hind-wing; of these two were "wet," the other was intermediate, tending to "wet," but I cannot say that these spots are characteristic of either sex or season. These butterflies often settled with the wings closed, but almost equally often with them widely opened; they seemed to sit either with head or tail to the sun. In two males a slight treacly odour was detected.

Here it must again[1] be admitted that in the field I was constantly confusing *Cupha* and *Cirrhochroa*, as the superficial resemblance is striking enough. *Cirrhochroa cognata*, Moore, is the commoner; Bingham held this to be indistinguishable from *thais*, Fabr., but de Nicéville appeared to consider it a local race. It is a strong flier and conspicuous on the wing, looking yellower than it is; it is also conspicuous when settled, usually upon a leaf, and often far out of reach. *Cupha* (*Messaras*) *placida*, Moore, which Bingham was inclined to regard as distinct from *erymanthis*, Drury, was reckoned by de Nicéville as "a good local race" of that species.

Among the fine butterflies peculiar to Ceylon is *Cethosia nietneri*, Feld., its engrailed hind-wings and somewhat Persian pattern seem to place it by itself. Its flight is extremely feeble, sometimes near the ground, but occasionally high; it sits on leaves with expanded wings, but occasionally visits *Lantana* flowers. Out of nine specimens taken two had suffered symmetrical injuries, one to the tips of the fore-wings, the other to the middle of the hind-margin of the hind-wings. *Cynthia asela*, Moore, is another large butterfly peculiar to Ceylon, it is remarkable for its sexual dimorphism, the male being tawny, the female French grey. It was common at Kandy, especially at the top of the hill above Lady Horton's Drive, but hard to get in good condition. There is no doubt that the male has a scent, faint, it is true; I compared it to sassafras and to French polish. The female varies in the width of the transverse white band. Two specimens had suffered symmetrical injuries to the hind-wings, which I attributed to a bird and a lizard respectively.

That glorious, though common, butterfly, *Hypolimnas bolina*, Linn. (*jacintha*, Drury), turned up from time to time. When spread out upon a leaf it looked particularly beautiful. Two specimens had symmetrical injuries to the fore-wings. Four specimens of the Blue Admiral, *Vanessa haronica*, Moore, were taken, all of them males, one at rest upon a stack of cord-wood sat with its head downwards. Both Bingham and de Nicéville regarded this as a geographical race of *canace*, Johanns., but it does not appear to me that Bingham's descriptions of either larva, pupa, or imago are consistent with that view, nor are the figures given by Moore and Bingham.

Curiously enough I met with but two *Atella phalantha* at Kandy. I see that Messrs. de Nicéville and Manders say of it: "Common everywhere in Ceylon, but not abundant."[2]

[1] For previous experience, see above, pp. 112, 114.

[2] "A List of the Butterflies of Ceylon," *Journ. Asiatic Soc., Bengal*, N.S., vol. lxviii., Part II., No. 3, 1899, pp. 170–233. An admirable paper.

Ergolis taprobana, Westw., which Bingham regarded as a race of *merione*, Cram., was abundant. It might be at once distinguished from *Cirrhochroa* by its skimming or gliding flight, which was hardly checked by a moderate amount of rain. It settles on leaves, or on the ground, with wings fully expanded, but frequently closes them for a moment and opens them again; on at least one occasion it was seen to orient itself. The allied *E. ariadne*, Linn. (*minorata*, Moore), was not quite so plentiful.

Telchinia violae was seen from time to time. It is tenacious of life; its yellow juice proved to be slightly bitter.

Three specimens of *Abisara echerius*, Stoll (*prunosa*, Moore), were all that the family of the *Erycinidae* could produce. On the other hand, Blues, more especially the smaller forms, were very plentiful whether measured by species or individuals.

Two examples of each of the somewhat dingy *Neopithecops zalmora*, Butl. (*dharma*, Moore), and *Spalgis epius*, Westw., were brought home, doubtless more were seen. *Chilades laius*, Cram. (*varunana*, Moore), was also apparently scarce, and the same was true of *Cyaniris puspa*, Horsf. (*lavendularis*, Moore). Of the tiny *Zizera gaika*, Trimen (*pygmaea*, Snellen), one of the most widely distributed of the Blues, Kandy produced but one; *Z. otis*, Fabr., of the form *indica*, Murray, was abundant enough, it flies very close to the ground; a specimen was noted to settle head downwards.

Talicada nyseus was common in one spot, where a quantity of its food-plant grew. The neat little *Everes parrhasius* was quite common; though not so tied to the soil as *Zizera*, it was not often seen far above it.

The genus *Nacaduba* is very puzzling, the more so as good specimens are not easy to obtain. So far as I can make out (following Bingham), I met with two species, both common, viz. *N. ardates*, Moore, and *N. atrata*, Horsf. (*prominens*, Moore, *pars.*). Three specimens of the latter were seen to settle head downwards. In two males a scent was detected; in one I described this as "sweet flowery," and my wife at once said, "That's a sweet smell"; in the other I gave a similar description, and my wife said, "very, very faint jasmine."

Unlike most of the other small Blues that I have mentioned, those of the genus *Lampides* are species of notable beauty, some indeed of almost dazzling brilliancy. Frequenting the leaves of shrubs and the lower branches of trees they formed a notable feature of the Kandyan fauna. The most abundant of them was the milky-looking *L. celeno*, Cram. (*aelianus*, Fabr.), an insect of quiet beauty.

I had many opportunities of watching it, and many times saw it settle head downwards, and certainly on at least three occasions observed that peculiar movement of the hind-wings which has been noted in so many of the Lycaenidae. Taking all my observations together it may be asserted that its male has a sweet scent, though this must be much fainter than in many Blues. In one specimen only did I note the scent as "decided," my wife then comparing it to hair-oil. The exquisite *L. lacteata*, de Nicév., has the reputation of being a rare species, but I took one specimen during my flying visit to Kandy in 1904, while on my second visit I was fortunate enough to secure twelve specimens, though four of them were in poor condition; all save one were males, while of the allied *L. elpis*, Godart, usually considered a commoner insect, I took but six, all males. At the time of capture all were examined for scent alike; the diagnosis of the species being made for the most part in England. It is therefore the more interesting to find that nine of the *lacteata* are noted as having a scent suggestive of chocolate or vanilla, whereas in five of the *elpis* a scent described as "sweet," but once as "? clover" was noted; seemingly it was not nearly so obvious as in the other species. *Elpis* is a wide-ranging species, but *lacteata* is confined to Ceylon. To me the difference between the two scents found in two forms, the distinctness of which has been doubted, is a matter of great interest. Two specimens of *L. elpis* were seen settled head downwards; one of them first settled with its head up, but forthwith turned round. One example of *L. celeno* had suffered a severe injury, apparently at the mouth of a lizard, the whole hind margin of one hind-wing together with an angular, adjoining portion of the fore-wing being absent.

There was yet another member of the genus, *Lampides bochus*, Cram., which in numbers did not fall far short of *celeno*. The males darting about in the brilliant sun reminded me of floating spangles in a pantomime. One example was seen settled head downwards.

I did not see a single *Catochrysops* at Kandy, but *Tarucus* was represented by two *plinius*, Fabr. Of *Castalius* I got two *rosimon*, both females, several *ethion*, and several *decidia*, Hew.

Of course *Polyommatus baeticus* was well to the fore, it frequents the flowers of low plants, seldom rising far from the ground. It was especially abundant on Lady Blake's Drive by the banks of the Mahaweli-ganga. Several were watched as they sat head downwards moving their hind-wings. The male has a moderately strong scent like that of Meadow-sweet.

Of the Thecloid groups of the Lycaenids I was not fortunate

enough to catch any of the more striking sorts. The somewhat dull *Surendra quercetorum*, Moore (*discalis*), occurred very sparingly. The slightly more attractive *Rapala lazulina*, Moore, was not common. I thought its male had a scent like chocolate, but my wife compared it to vanilla biscuits, a distinctly closer comparison. Chocolate is so frequently flavoured (and therefore scented) with vanilla that one's imperfect sense-organ often fails to distinguish the true smell of the chocolate (as for instance in cacao-butter) from that of the vanilla. I believe both scents are found among butterflies. In *R. lazulina*, I specially noted that the lobes on the hind-wings are everted, as in *Aphnaeus*.[1] A single *Virachola isocrates*, Fabr., a female, occurred on the top of the hill above Lady Horton's Drive.

The long-tailed *Loxura arcuata*, Moore, was quite common in the "half-mile gallop." It is a singular insect with a darting flight, and it rests in a peculiar attitude. The head is usually directed downwards, the wings closed above the insect's back, with the lobes of the hind-wings three-quarter everted, showing an eye-spot when viewed from above. The inner margin of the hind-wing is bent inwards. The long tails are crossed with their tips turned upwards in a curve, and they appear to be somewhat twisted.[2]

So much for the Lycaenids. The Pierines made a more goodly show but were not really as numerous. Of the ghostly little *Leptosia xiphia* I saw but one at Kandy. *Delias eucharis* is as interesting a butterfly as it is beautiful. Though believed to be distasteful I took two specimens with well-marked symmetrical injuries, involving in one case both fore-, in the other both hind-wings. It appeared to be somewhat tenacious of life, though not nearly so hard to kill as the Danaines. In the course of my Indian tour[3] I had detected a scent in this butterfly, but was in some doubt as to whether it existed in the female as well as in the male; accordingly, the butterfly being common at Kandy I examined a number of specimens. Dr. Dixey had informed me that the scent-scales are very numerous in the male *Delias*. As a result of my investigations I can state with confidence that the male *D. eucharis* has a strong scent, sometimes very strong (so as to be perceptible when the insect is fluttering in the net), which may, I think, be well described as like that of sweet-briar. As regards the female I speak with less assurance: nevertheless a majority of those examined had a *very faint* scent, which I described as "sweet" (twice), "dusty or musty," "flowery," "sweet-briar"

[1] See above, p. 68, and Fig. 5.

[2] For the resting attitude of the closely allied *L. atymnus*, Cram., see above, p. 73.

[3] See above, pp. 85, 86.

(twice). Mrs. Longstaff once called it "sweet," twice failed to detect any scent: once said, "very slight lemon-verbena; yes, perhaps more like sweet-briar," but once she said, "a little gentle sort of scent; query ginger, or coarse brown sugar."

Though *Catopsilia pyranthe* seemed to be common in the lower country, I came across but a single male at Kandy; it is interesting that the ordinary way of testing for scent gave a negative result, but that when the tufts or fringes were disturbed a strong *Freesia*-like scent was evolved. In contrast to this *C. pomona* was plentiful; they varied very much in size; some specimens appeared to have been out a long time, one being stained. The great majority were of the *pomona* form, but four were decidedly of the form *crocale*, Cram., while two were transitional between these forms. On the other hand, there were three of the *catilla*, Cram., form, while two approached *catilla* in character. As regards time—while *crocale* occurred from January 17 to February 11, no *catilla* were seen before February 2, and the last (transitional) was taken on March 2. I several times beat this butterfly out of *Tithonia diversifolia*, a rank Mexican Composite that has been recently introduced; once this occurred after rain when everything was very wet; it seemed to be fond of resting among the leaves of the topmost shoots. *C. pomona* is a flower-frequenting butterfly, being especially fond of the Vervain, *Stachytarpheta jamaicensis* (another introduced plant). It looked particularly handsome, feeding on its purple flowers, its greenish yellow colour forming a fine contrast, and reminding me of *Callidryas eubule* seen the year before at the same flowers at Port Antonio, Jamaica. There was some slight evidence of unusual tenacity of life in *Catopsilia*, but I do not lay stress on this. The scent of the male varied in intensity in different individuals, but though usually distinct was seldom very strong. I compared it often to *Freesia*, once to *Stephanotis*. In several females a very faint sweet or flowery scent was detected, but it was of different quality to that of the male. Injuries were observed in several specimens: a ♂, hind-wings, symmetrical; a ♀, hind-wings, symmetrical, (?) due to a bird; a ♂, a small injury involving all four wings, (?) due to a bird; a ♀, anal angles of fore-wings, symmetrical; a ♀, tips of fore-wings, symmetrical; a ♀, tips of hind-wings and anal angle of fore-wings, symmetrical; a ♀, apices of hind-wings, symmetrical; a ♀, apices of hind-wings, symmetrical. This is a strongly built butterfly and not liable to accidental chipping as are many delicate Satyrines: in no other species were so many mutilated individuals met with.

I do not know anything that is more closely associated in my

mind with hot countries than the merry gambols of the little yellow butterflies of the genus *Terias*. There is still considerable doubt as to the number of species belonging to the *hecabe* group. It will be seen that the question is by no means a simple one when it is borne in mind that not only do the sexes differ, but that both sexes are influenced by season so as to exhibit a wet-season and a dry-season form, the latter being commonly more marked in the female. Moreover there are intermediate forms of all grades. Lastly, at least one of the species, or sub-species, or races, into which the insects of the *hecabe* group may be divided is extremely variable in respect to the width of the black marginal borders to both wings. While Messrs. Butler, Moore, and Swinhoe have described about thirty species, on the other hand Dr. Dixey at present includes them all under *hecabe*—provisionally at all events.

Looking at the matter from a Ceylon point of view, one fact is prominent. Mr. E. E. Green and other experienced local collectors are familiar with two forms of larva, the one more or less solitary in its habits, having a green head and turning to a green pupa; the other gregarious, with a black head and producing a dark brown or black pupa. The latter we are told always produce butterflies with the character said by the late Capt. E. Y. Watson[1] to distinguish *T. silhetana*, Wallace, viz. a dark spot at the extreme base of the cell on the underside of the fore-wing, a character which he declared to be absolutely constant. The late Col. C. T. Bingham stated that the dry-season specimens of *hecabe* might be distinguished from *silhetana* (as well as from *sari*) by the reddish-brown season-mark near the apex of the fore-wing on the underside, forming a line or bar, sharply defined externally, whereas in the other forms it extends more or less towards the apex, forming a patch rather than a bar; in *silhetana* this patch is especially developed in the female.

Now, in 1908 I brought home from Ceylon 136 *Terias* of the *hecabe* group. Rejecting four specimens (believed to be three *hecabe* and one *silhetana*) which were in such poor condition that no certain determination was possible, there remain 132. The large majority of these—eighty-four specimens (53 ♂, 31 ♀)—had, besides the reniform mark on the disco-cellular veins, two brown marks in the cell. These I call *hecabe*. In thirty-seven specimens (26 ♂, 11 ♀) there were three brown marks in the cell, the additional mark being a small dot at its extreme base. These I call *silhetana*. There remain eleven specimens (5 ♂, 6 ♀) having a distinct facies: they have but one dark mark in the cell, a transverse line. These seem to me to be *rotundalis*,

[1] He was "sniped" in camp during the Tirah campaign, Nov. 8th, 1897.

as figured by Moore. Now Bingham made *rotundalis* a synonym of *silhetana*, but to me it seems rather to be allied to *sari*, Horsf. Seven of my *rotundalis* (4 ♂, 3 ♀) are decidedly "wet"; the remaining four (1 ♂, 3 ♀) are "intermediate, tending to wet." All have the dog's head profile quite distinct. My eighty-four specimens of *hecabe*, all—20 ♂, 19 ♀, "dry"; 21 ♂, 7 ♀, "wet"; 12 ♂, 5 ♀, intermediate—have the black border of the fore-wing sufficiently wide to show the dog's head profile clearly. In all of them there are two marks in the cell, and two only. In all the dry-season specimens the season-mark is a transverse bar clearly defined on the side towards the apex. In the thirty-seven *silhetana*, on the contrary, the narrowness of the black margin makes the dog's head profile shallow, indistinct, or obsolete, in no less than twenty-one out of the twenty-six males, though it is distinct enough in ten out of the eleven females.

Captured specimens are extremely difficult to deal with, but Mr. Green has been good enough to send to the Hope Department a number of butterflies reared from the gregarious, black-headed larvae; they are all clearly referable to *silhetana*. At present we seem to lack material to decide the limits of variability of *T. hecabe*, though Mr. Pryer's results in Japan seem to show that they must be very wide.[1]

As already stated the *Terias* taken on the West Coast were all *hecabe* as above characterized. The sixty specimens taken at Kandy included all three forms: *T. hecabe* was represented by twenty "dry" specimens (10 ♂, 10 ♀) as against three "wet" (all males), and four intermediate (all males). *T. silhetana* was represented by seventeen "dry" specimens (7 ♂, 10 ♀) as against two "wet" (both males), and six intermediate (all males). Of *T. rotundalis*, on the other hand, there were no "dry" examples among the eight taken, but there were four "wet" (2 ♂, 2 ♀) and four intermediate (1 ♂, 3 ♀). It is possibly significant that no *rotundalis* were taken at Kandy until I had been there ten days, although both *silhetana* and *hecabe* were common on my arrival. Is *rotundalis* perhaps a wet-season form of *silhetana*?

Not one single *Ixias* or *Teracolus* was seen during my stay at Kandy; moreover I seem to have taken but five specimens of *Catophaga* (*Appias*) *paulina*, Cram., 3 ♂, 2 ♀.

The magnificent *Hebomoia glaucippe*, Linn., f. *australis*, Butler, was very rarely seen at Kandy, the few noticed (and it was scarcely possible not to notice them if present) were attracted by a *Lantana* hedge. *Huphina nerissa*, Fabr. f. *phryne*, Fabr., was seen twice only.

[1] H. Pryer, "Rhopalocera Niphonica," 1886, pp. 8, 9.

The glorious sub-family of the Papilionines, Linnaeus' ideal butterflies, forms quite a feature of the Ceylon landscape; they do not require looking for, since they force themselves on the attention. On the occasion of my first visit to Ceylon, in the middle of March, 1904, I met with but one specimen of the black and green *Papilio agamemnon* (see above, p. 112), but in 1908 it was certainly the commonest of the genus, being in fact abundant in the latter half of January. Though nearly all the specimens were more or less tattered and torn, in one the injuries affected both hind-wings symmetrically, and I deemed them to be probably the result of an attack by a vertebrate enemy. This butterfly especially favoured the hill-top, where it might be seen fluttering its wings—from time to time momentarily closing them—as it sipped honey from *Lantana, Stachytarpheta* or *Vernonia.* When on flowers it was easily taken, but it is surprising how inconspicuous it is, as well during its swift darting flight as when settled. In marked contrast with *agamemnon* is the truly magnificent *P. crino,* Fabr., its brilliant green which when in the hand gleams like a diamond beetle, seeming almost luminous in tbe sunlight. The first sight of it caused a never-to-be-forgotten thrill of delight. It is not easy to catch, moreover it frequently breaks off its tails by violent fluttering in the net. I saw scarcely a dozen specimens in all, mostly attracted by *Lantana* bloom, though chary of settling on the flowers. The form taken in Ceylon is *P. montanus,* Felder, but this is not peculiar to the Island.

Papilio pammon was fairly common at Kandy. This butterfly is far more difficult to catch than either *P. aristolochiae* (which is undoubtedly a distasteful species) or *P. hector.* Unfortunately I secured but two females, one of the form *cyrus,* Fabr. (that resembling the male, being Wallace's form I.), the other of the interesting form *romulus,* Cram. (Wallace's form III.), a good mimic of *P. hector,* a species which could scarcely be called common. The latter is unquestionably tenacious of life, a point that I have *not* noted in *pammon.* Again, *hector* has a somewhat musty odour; whereas in the only specimen of *pammon* in which I detected any scent it was somewhat agreeable.

P. aristolochiae, f. *ceylonica,* Moore, is almost as difficult to kill as *hector;* it flies slowly, going straight on, and has a scent that I once compared to that of new black net, but more usually to that of musty hay. It was quite common at Kandy. Of *P. demoleus* I saw but one or two. Of *P. lankeswara,* Moore, f. *dissimilis,* Linn., and of *P. sarpedon,* Linn., race *teredon,* Feld., one each. On the other hand the Ceylon race of *P. polymnestor,* Cram., which Mr. Rothschild

ranks as a sub-species (*parinda*, Moore), was almost common. It is a grand insect on the wing, but not easy to catch.

It may be remembered (see above, p. 111) that on my first visit to Kandy I was told that the male of the big *Ornithoptera darsius* had a scent like that of sassafras. At Kandy I was unable to procure that drug, but the Apothecaries' Company of Colombo were good enough to send me some blotting paper that had been moistened with oil of sassafras, and I was thus enabled to make a direct comparison, with the result that the two odours appeared to be almost identical. This butterfly, certainly the most distinguished of those peculiar to Ceylon, was frequently to be seen, and when within reach it was not hard to catch.

The Skippers are so very puzzling that it is almost out of the question to diagnose them in the field; the best way therefore is to box all that you come across and examine them at home; they usually travel well so, whereas pinching is especially destructive to members of the family since their large scales seem to be very easily rubbed off. At first I remarked that Skippers were very scarce at Kandy, but they got commoner as the season advanced. I had noticed in South Africa that insects of this group are early risers, and I took one of the dingy little *Sarangesa albicilia*, Moore (peculiar to Ceylon), rather early one morning. Of the handsome *Tagiades obscurus*, Mabille (*distans*, Moore), I took one off Vervain flowers, on which it sat with wings fully expanded. Near the hill-top I took two of the striking black and white *Tagiades atticus*, Fabr., settled on the upper surface of leaves. A solitary specimen of the small greyish *Hesperia galba*, Fabr., was all that I saw of the species.

Iambrix salsala, Moore (*Astictopterus stellifer*, Butl.), was rather common. The tiny grey *Taractrocera maevius*, Fabr., was occasionally met with among low herbage, but as it looks quite like a fly when on the wing, it might well have been overlooked. Of the brilliant little *Ampittia dioscorides* (*maro*), Fabr., the females—which are very different from the males—predominated. *Telicota bambusae*, Moore, a very wide-ranging species, has a more European appearance than most of the preceding; I took but one, a male, and noted that its hind-wing was folded when the creature was at rest. The neat, black and white *Notocrypta feisthamelii*, Boisd. (*Plesioneura alysos*, Moore), and the tawny *Padraona gola*, Moore, were both unique, but of *Halpe ceylonica*, Moore, I secured two specimens.

Next I must mention three species which belong to a very difficult group and may be quite easily confounded, though really distinct enough. *Parnara mathias*, *P. guttatus*, Brem. & Grey (*bada*,

Moore), and *P. colaca* (*cingala*), Moore. Of the first I got five, of the second one, and of the third eleven specimens at Kandy. It is curious that of the last Messrs. de Nicéville and Manders say: "We have no exact locality for this species from Ceylon, and Moore gives none." I cannot be more "exact" than to state that ten of mine came from Lady Horton's Drive, *sensu largiori*; one from the road above the Reservoir, while I got yet another from near the Abhayagiriya Dágoba at Anuradhapura.

P. mathias rests with all the wings up; *P. colaca* with fore-wings quite, hind-wings nearly up, but both sloped back.

High above the reservoir which supplies Kandy with water, one sunless afternoon I took a specimen of the large but dull *Parata butleri*, Auriv. (*alexis*, Moore, *nec* Fabr.), it was on a *Vernonia* flower. A single specimen of the rare *Bibasis sena*, Moore, an insect much like the last, but larger, was taken on the hill-top above Lady Horton's Drive; it is very inconspicuous for its size, and when at rest folds its hind-wings. Another species of similar general look, *Badamia exclamationis*, Fabr., was a little commoner; it was taken on *Vernonia* flowers, sitting with all its wings up and much sloped back, the hind-wings being folded. One specimen was seen to settle *under* a leaf. It is not easy to get these large Skippers in good condition as they are violent in their ways, and moreover their scales, especially those of the thorax, are but loosely attached.

So much for the Butterflies. I scarcely worked for Moths, save to box such as came to the lights of the hotel. These included two species of Syntomid: the dingy *Syntomis passalis*, Fabr. (two), my wife also found under a stone near the hotel a pupa from which the moth emerged in four days; and the black and white *S. cyssea*, Stoll, (four), two of f. *georgina*, Butl., and two of f. *cysseoides*, Butl. The tiny *Eressa subaurata*, Walk., occurred on a wall in the hotel garden.

Though small in size the Lithosiines were amongst the most characteristic of the visitors to the lights. Of these the commonest was the little speckled grey and black *Siccia* (*Aemene*) *taprobanis*, Walk., but of the neat cream-colour and black *S. guttulosana*, Walk., there came but one. Several species of *Asura* (*Setina*), buff-coloured insects suggestive of, but smaller than, our *irrorella*, Linn., were taken; *A. solita*, Walk., five; *A. arcuata*, Moore, two; and *A. semifascia*, Walk., one. *Gampola fasciata*, Moore, and *Ilema* (*Katha*) *brevipennis*, Walk., are both obscure species which occurred singly; so also did *Chamaita* (*Homopsyche*) *nympha*, Moore (a close ally of our *Nudaria*). More distinctive was *Chionaema* (*Bizone*) *peregrina*,

Walk. (*puella,* Moore, *nec* Drury), a pretty white and scarlet moth, which was also beaten out in Lady Horton's Drive.

It was somewhat surprising that only one Arctiid turned up, the handsome ermine *Creatonotus gangis* (*interruptus*), Linn., which was, however, common; it is pinkish-grey with a longitudinal dark stripe, and has a crimson abdomen. One specimen was noted as having a strong musty smell.

The tiny Acontiid *Noctuae* were sometimes thought to be *Tortrices,* so small are they. The pinkish-grey *Enispa* (*Micraeschus*) *oblataria,* Walk., for example, is but 13 mm.—say half an inch—in expanse; one occurred in the hotel at Colombo, one at Kandy. Again the little pink, yellow-fringed *E. croceicincta,* Hmpsn., might well be taken for a Geometrid allied to *Hyria,* or even for a relative of *Pyralis costalis.* Then there were the pretty little *Tarache tropica,* Guen., of which a specimen was also met with at Peradeniya by day; *Lithacodia* (*Acontia*) *signifera,* Walk.; *Rivula simulatrix,* Hmpsn., and the larger orange and chocolate-coloured *Cosmophila erosa,* Hübn., a very widely distributed insect.

The *Quadrifinae* that came to light were the variable *Ercheia* (*Melipotis*) *cyllaria,* Cram., its dark hind-wings curiously marked with three white spots; the patchy *Chrysopera* (*Achaea*) *combinans,* Walk., its purplish fore-wings bearing a pale costal patch, its hind-wings with yellow apices; the huge *Nyctipao macrops,* Linn., for all the world like a large Old Maid decorated with big ocelli. Added to these one of the hotel servants brought me *Ophideres fullonica,* Linn., a large Yellow Underwing.

Three Deltoids also came to light, *Rhynchina angulata,* Walk. (*plusioides,* Butl.), two specimens; *Hypena varialis,* Walk., and *Progonia patronalis,* Walk., one of each.

Though the Lymantriids are day-flying moths the following came to light: *Euproctis semisignata,* Walk. (*citrina,* Moore), a female; *E. scintillans,* Walk., a female; *E. cervina,* Moore, a male, and *Aroa subnotata,* Walk., a female.

A solitary Limacod, the small speckled *Narosa conspersa,* Walk., was a marked contrast to *Eupterote mollifera,* Walk., a handsome yellow-brown moth suggestive of a glorified male Drinker; it is variable, the two males that came to the lights being very different in colouring. Then there was a white Uraniid very delicately lined with grey, *Pseudo-micronia coelata* (*fraterna*), Moore, suggestive of *Ourapteryx.* The Geometers at light were few and comparatively insignificant, perhaps the most noteworthy was *Hyposidra talaca,* Walk., a pretty purple-brown, hook-tipped moth, and the dull

Emerald, *Hemithea tritonaria*, Walk., but *Craspedia* (*Idaea*) *fibulata*, Guen., and *Idaea actuaria*, Walk., were of very ordinary Acidaliid type. The usual crowd of Pyrales turned up: *Nacoleia diemenalis*, Guen., a widely distributed species (like our *purpuralis*), of which a specimen was found by day close to the hotel; *N. tampiusalis*, Walk.; *Endotricha mesenterialis*, Walk. (like a bright *flammealis*); the universally distributed *Diasemia ramburialis*, Dup., and *Zinckenia fascialis*, Cram.; the pretty white, pink-tipped *Noorda fessalis*, Swinh., also wide-ranging; *Glyphodes celsalis*, Walk.; *Sylepta adductalis*, Walk.; a finely marked *S. iopasalis*, Walk., which my servant brought me, had probably also been attracted by the hotel lights; the pretty *Leucinodes orbonalis*, Guen.; tbe creamy *Pyrausta incoloralis*, Guen., a wide ranging insect; *Pachyzancla phoeopteralis*, Guen., which was commoner than any of the preceding; *Hellula undalis*, Fabr.; and the brick-red *Bostra pallidicosta*, Hmpsn., which passed muster as a Noctuid. The Crambids were represented by two or three *Schoenobius bipunctifer*, and quite a number of the more attractive *Ancylolomia chrysographella*, Koll. (*taprobanensis*, Moore); the Phycids I may say of course included *Etiella zinckenella*, Treits., but only one specimen; with it were *Epicrocis aegnusalis*, Walk., and *E. lateritialis*, Walk. Not the least interesting of the visitors was the fine Tineid, *Hapsifera seclusella*, Walk., of which three females turned up. Less striking was the Gelechiid, *Timyra irrorella*, Wlsm. The tiny black and ochreous Zygaenid, *Dendrocera quadripunctata*, Hmpsn., was found in the hotel, but whether it had been attracted by light I cannot say.

But besides Lepidoptera other insects, amongst which Beetles were the commonest, came to the botel lights:—The tiny Lamellicorn *Orphinus mysorensis*, Westw.; *Copris repertus*, Walk., and *C. signatus*, Walk.; the formidable-looking *Oryctes rhinoceros*, Linn.; *Onthophagus turbatus*, Walk.; *O. dama*, Fabr.; *Macrocheilus tripustulatus*, Fabr.; the black Elater, *Melanotus hirticornis*, Herbst; *Apogonia rauca*, Fabr.; *A. solida*, Walk.; and a *Coelolophus*, represented in the British Museum from Ceylon, but unnamed.

A Mole-cricket, *Gryllotalpa* sp., was among the less common visitors, also a male *Dorylus orientalis*, Westw. The black and yellow Wasp, *Odynerus fistulosus*, Sauss., had perhaps lost its way. There were two Bugs, the common green, very fetid Pentatomid, *Plautia fimbriata*, Fabr., and the black, orange-spotted Reduviid, *Acanthaspis angularis*, Stål, bearing a formidable recurved spine on its shoulders. One night a great number of Termites came; one of them confined in a pill-box was observed to have shed its wings within an hour and a half of its capture.

I did not come across very many moths by day, but this may well be because little time was devoted to hunting for them. However, the handsome Agaristid, *Eusemia nigripennis*, Butl., did not need much looking for; it is a large black moth with primrose-yellow markings. I saw but one example, which flew very slowly in the full sunshine and settled on a leaf with wings fully expanded. The pretty white and bronze-green *Chalcosia thallo*, Linn. (*venosa*, Walk.), also compelled attention by its slow, weak, vapouring flight. This moth is much given to fluttering about trees and bushes, and one afternoon was seen in considerable numbers about the trunk of a tall tree (*Litsaea zeylanica*); it is very tenacious of life, resisting chloroform as well as pinching, and has a peculiar, disagreeable, musty odour, not at all strong and seemingly present in both sexes; on pinching much yellow juice is expressed, which appeared to have a slightly bitter taste. Though not at all related to *Chalcosia*, one cannot help mentally associating *Deilemera* (*Nyctemera*) with it; of *D. coleta*, Cram. (*nigrovenosa*, Moore), a delicately marked insect with weak flight, three specimens were taken flying in more or less bright sunshine. This insect also is tenacious of life, but scarcely so markedly as *Chalcosia*; it also yields a yellow juice, which seemed to be very slightly bitter. A specimen of *D. lacticinia*, Cram., surprised me by coming to light at the hotel.

Associated in my recollection with both *Chalcosia* and *Deilemera* is the fine Geometer, *Euschema palmyra*, Stoll (*transversa*, Walk.), a large grey-blue, black-spotted, Tiger-like moth, a very slow day-flyer, of which I took two specimens; and by the kindness of Mr. Tylecote brought home a third, taken by him at Peradeniya. This moth is extremely hard to kill. The little two-tailed *Epiplema conflictaria*, Walk. (*lilacina*, Moore), was seen spread out very flat upon a leaf.

One drizzling day I made a dash at a swiftly flying Lycaenid, as I thought, but found in my net a smoky Psychid, *Heylaertsia griseata*, Hmpsn., of course a male. Several Lymantriids also were taken on the wing, some in full sun, *e.g.* *Lymantria ampla*, Walk., and *Aroa subnotata*, Walk., both with quick darting flight, also the pretty pink, yellow-spotted *Euproctis scintillans*, Walk.

One of the hotel servants brought me on three occasions living specimens of *Acherontia lachesis*, Fabr., which he had found on the trunks of Palms in the garden; two of them squeaked loudly when touched; it is closely allied to our Death's Head moth. One windy day I picked up *Daphnis hypothous*, Cram., on a path by the lake; it is very like the European *nerii*.

Day-flying Noctuids do not seem to be in any way characteristic

of Kandy, but on my second visit to Lady Horton's Drive at about noon on a dull day the triangular form of the large pale fawn-coloured Yellow Underwing, *Ophiusa indiscriminata*, Hmpsn. (*discriminans*, Moore, *nec* Walk.), caught my eye as it rested on a fern; later on I took two of the obscure *Amyna punctum*, Fabr. (*selenampha*, Guen.). On the hill above the Reservoir, at about 2000 ft., I took a specimen of the striking yellow-underwinged Deltoid, *Dichromia erosa*, Guen.

A specimen of the delicate green *Glyphodes pomonalis*, Guen., was unfortunately in poor condition. Close to the Reservoir I kicked up out of rank wet grass the well-named *Phryganodes obscurata*, Moore, and higher up the hill the singular *Filodes fulvidorsalis*, Hübn., with long antennae and long yellow body. A male of the Tineid, *Timyra machlas*, Meyrk., turned up in Lady Horton's Drive.

My solitary Plume, Mr. Bainbrigge Fletcher tells me, is *Alucita candidalis*, Walk. (*leucodactyla*).

One hot day, on a bank above Lady Anderson's Road, I saw an insect, which I took for a *Bombylius*, hovering at a flower; in the net it positively hummed, but on closer inspection I thought it might be a Skipper. However, it ultimately proved to be a Clear-wing, *Melittia chalciformis*, Fabr., a strange-looking creature with very hairy hind legs.

The following were met with in various places in the immediate neighbourhood of Kandy, chiefly on Lady Horton's Drive or thereabouts.

Hymenoptera: *Salius flavus*, Fabr., a large black Wasp with legs, wings and antennae ferruginous; the tough-skinned *Discolia leviceps*, Smith; the formidable Hornet, *Vespa cincta*, Fabr., occurred in many places, but most commonly about a large patch of *Vernonia* above the Reservoir; it was not seen to catch anything, nor to feed on the flowers; it has a very faint hum, a pure low-pitched note free from any buzz. The Bees included a single specimen of *Ceratina* sp.; the brilliant *Podalirius zonatus*, Linn., conspicuous by the metallic sky-blue bands on its abdomen, often to be seen hovering at the flowers of Vervain (*Stachytarpheta*); the Honey-bee of the country was evidently *Apis indica*, it was abundant; *A. dorsata*, Fabr., of which I took but one specimen, is a large bee with an orange waistband; *Nomia ellioti*, F. Smith, var., occurred at Vervain, with apparently another member of the genus; of the Carpenter-bees I met with three species, *Xylocopa tenuiscapa*, Westw., two females, *X. nigro-coerulea*, Smith, two, and *X. collaris*, Lepel., one; I also took

a single Cuckoo-wasp, the brilliant green *Stilbum splendidum*, Fabr.[1]

Coleoptera were not so numerous as might have been expected, but it must be remembered that I paid but little attention to the order. The Tenebrionid *Ceropria induta*, Wied., was abundant under rotting logs on Lady Anderson's Road, it is swift in its movements and brilliant in the sunshine with its violet-pink iridescence; in like situation I took one of the horned *Anthracias* (*Toxicum*, Latr.) *oppugnans*, Walk., together with two of the Endomychid, *Eumorphus pulchripes*, Gerst., a pretty orange and black fungus-eater, and several of the Passalid, *Tiberius waterhousei*, Kaup; also under logs in the same place the almost uniformly red *Lycostomus similis*, Hope, together with the excessively hard—impossible to pin—*Xylinades westermanni*, Schönh. (possibly the same as *sobrinulus*, Dohrn *in MS.*), and two Carabids of the genus *Coptodera*. Several Carabids of the genus *Omphra* were taken higher up above the Reservoir, together with a number of *Pseudo-blaps javanus*, Wied. At rest on a Palm leaf I found the red and black *Telephorus dimidiatus*, Fabr.

In Lady Horton's Drive I took on the wing the undescribed Longicorn *Oberea cylindrica*, Gahan *in MS.*, a small, slender, pale red insect with black-tipped elytra. A native child standing close to me picked a specimen of the large Longicorn *Xylorrhiza adusta*, Wied., off the stem of a woolly-leaved shrub; it was extremely cryptic, looking like a piece of dead wood. A Weevil of the genus *Alcides* was taken in the hotel garden by beating. In and about the buildings of the hotel, I took several specimens of the Heteromerous beetle *Derispia coccinelloides*, Westw.; since the great Hope Professor gave it that name perhaps I, a humble Lepidopterist, may be forgiven for having taken it to be a Lady-bird [see Plate IV., Fig. 11].

Hemiptera were quite numerous, by far the most conspicuous being the black-spotted, metallic, golden-green Pentatomid, *Chrysocoris stockerus*, Linn., which was commonly to be seen flying in the sun; it was almost as offensive as beautiful. Shortly after death the golden tint is to a great extent replaced by blue. Is this due to the fading of a yellow pigment, the interference colours remaining constant? The only other Pentatomid was the widely distributed, very fetid, green *Plautia fimbriata*, Fabr. The pale red Coreid, *Serinetha abdominalis*, Fabr., was taken on the wing. The Lygaeids were represented by abundance of the little *Nysius ceylanicus*, Motsch., which swarmed upon the flowers of the introduced *Erigeron canadense*, a wandering plant which finds a home alike in the valleys

[1] Some recent writers call this well-known insect *S. cyanurum*, Forst.

of the Thames and the Mahaweli-ganga; also by *Dysdercus cingulatus*, Fabr., a bug that varies much in size and colour, as its black spots may be placed on either a pale red or a grey ground; *Graptostethus argentatus*, Fabr., was found above the Reservoir; and the pale red *Dindymus sita*, Kirby, lurked under a stone; the dingy *Brachyrrhynchus membranaceus*, Fabr., is well adapted by its extreme flatness to its habitat under loose bark. Reduviids were to be had in some variety, the black and red *Lophocephala guerini*, Castel., was found on the road, it had apparently been injured and was unable to fly; *Sphedanolestes nigro-ruber*, Dohrn, which was netted on the wing, is evidently a scarce species, since Mr. Distant had never seen it before I showed it to him; *Coranus obscurus*, Kirby, is featureless as its name implies; *Conorrhinus rubrofasciatus*, De Geer, is black with reddish marks; the dull coloured *Petalochirus brachialis*, Stål, being armed with spines on its shoulders and along the abdomen, ought to be treated with circumspection, for owing to the lack of it I pricked myself smartly. The black *Sycanus collaris*, Fabr., which has long thin antennae, flew briskly in the sunshine, making a sort of hum or buzz.

Diptera were not very prominent, at all events I did not take many: an undetermined *Musca*; a species of *Idia*; *Rhinia discolor*, Fabr., the two last about the flowers of *Wendlandia notoniana*, Wall.; an undescribed species of *Blepharipoda*; *Sarcophaga sericea*, Walk., and an undescribed *Chaetodyga*, which has a singularly raucous buzz.

Two remarkable Whip-scorpions, *Thelyphonus* sp., must not be forgotten; I took them, one a little below, the other somewhat above the Reservoir, both under stones. They emit an extremely pungent odour of acetic acid (which however soon passes off in the cyanide-bottle), and the name *Oxypoei* is well applied to the group.

The Royal Botanic Gardens at Peradeniya were by no means productive of insects, as regards either species or individuals, being, probably, too well kept; but I suspect that the well-known poverty of gardens as entomological hunting grounds is in the main due to the paucity of indigenous plants therein. One, all too small, portion of the garden is purposely kept in a more or less wild state, and this was the only place in the island in which I saw *Danaida plexippus*, Linn. (*genutia*, Cram.). Close to Mr. Green's laboratory I took *Precis orithyia*; my only other Ceylon specimen of this common Indian butterfly was found on the road above the Reservoir at Kandy. *Cyaniris puspa* is another capture worth mentioning. The pretty

little *Yphthima ceylonica* was the one really common butterfly at Peradeniya.

In the Gangaruwa Jungle close by I captured a male *Melanitis ismene* of the dry-season form, also, at rest upon a rock, the tiny Burnet-moth, *Dendrocera quadripunctata*, Hmpsn.

In Lady Blake's Drive along the opposite bank of the Mahaweli-ganga, *Terias libythea*, Fabr., was not uncommon, but it did not occur at Kandy, the specimens of both sexes were of the wet-season form. Of *T. venata*, Moore, I met with but two individuals in Ceylon, both wet-season males, one in the gardens, the other in Lady Blake's Drive, not far away. Of the *T. hecabe* group I got in the Peradeniya district sixteen specimens altogether; of these I referred a single "wet" male to *rotundalis*, two males—one "wet," the other intermediate—to *silhetana*, the remaining thirteen to *hecabe*, six of them "dry" (1 ♂, 5 ♀), three "wet" (2 ♂, 1 ♀), and four intermediate (3 ♂, 1 ♀).

It was on Lady Blake's Drive that a large butterfly proved almost too much for both Mr. Green and myself; a *Tirumala septentrionis*, as we thought, eluded us over and over again, though it is usually an easy thing to net. At last, after repeated efforts, Mr. Green's superior skill conquered, and to our surprise there was in his net *Papilio lankeswara*, f. *dissimilis*. Yet I should underestimate the power of Mr. Green's vision if I said that it equalled that of the average hawk. This will give some idea of the occasional perfection of mimicry.

A few insects of other orders were taken in what I may call the Peradeniya district, but they were neither numerous nor important. When I was out with Mr. Green he found a Carabid of the genus *Coptodera* and the Heteromeron, *Pseudo-blaps javanus*, under stones; the small Lamellicorn, *Singhala hindu*, was to be got in abundance in the flowers of a (?) *Cistus*; along with it were *Haptoncus pubescens*, Murray, and the tiny *Idaethina orientalis*. The Lycid, *Lycostomus similis*, looked very red as it flew to a Mango leaf on which it settled. On damp rocks in the shade, near the river, I found several *Derispia interrumpens*, Walk.;[1] it is notable that while Westwood called another species of this genus *coccinelloides*, Walker described his species as actually belonging to the genus *Coccinella*, so like are these *Heteromera* to Lady-birds.[2] The tiny Pentatomids, *Coptosoma*

[1] See Plate IV., Fig. 12.

[2] It must be admitted that I did not see any *Coccinellae* for the *Derispiae* to

siamica, Walk., a very variable species which is common in the flowers of the introduced *Tithonia diversifolia*, are almost as much like Lady-birds. A very grey *Dysdercus cingulatus* was netted on the wing.

It was on Lady Blake's Drive also that I took the huge *Discolia indica*, Sauss., a fearsome black creature with bands of red bristly hairs on its abdomen, while, as is usual, a Mango-tree in full bloom attracted a number of Bees, chiefly *Apis indica* and a species of *Melipona*, but among them were a couple of the large *Apis dorsata*, Fabr. The only Fly that I brought home was *Rhinia discolor*, Fabr.

A day expedition to Sanda Polla Forest, a large plantation about 28 miles N.W. of Kandy and about 400 ft. above sea level was in several respects a disappointment. I chartered a small motor and set forth gaily, ever and anon driving the terrified natives, their children, and their beasts, to right and left as we sped along the beautiful road with much tooting. Of course there was not time to stop at the most promising part. An excellent lunch at the best rest-house that I have seen in the East, Kurunegala, consumed more valuable time; however I got to the forest at last, having picked up a very civil native officer of the Forest Department. I had scarcely realized to what an extent the forest was artificial and was consequently surprised that the only insect other than such as I saw daily in Lady Horton's Drive, was a single *Chilades laius*, Cram., f. *varunana*, Moore, the wet-season form. A wet-season male and an intermediate female *Terias hecabe* were taken, as well as an intermediate male *T. silhetana*. Even Beetles were very rare, although the forest-officer gave grand accounts of the Longicorns that he was in the habit of sending away. One log, a rotten one, yielded the Dung-beetle *Catharsius molossus*, Linn., and five specimens of *Tiberius waterhousei*, Kaup.

Presently the chauffeur said it was time to be off, and somewhat reluctantly I folded up my net. It was just as well that we did start then, for when we were about halfway home the car fell sick, it seemed to have a paralytic stroke. I was not sorry to get out and walk, leaving the car to follow, as I hoped to pick up some insects. The nearly dry bed of a small river looked promising, so I went down to explore it and look for butterflies drinking. On turning a sharp corner I found myself confronted by a huge Elephant which seemed to block the way with his widespread ears. There was a nervous moment until his mahout returned, for it is said that elephants are

mimic, and there does not appear to be any Ceylon Ladybird at all similar to them in the National Collection.

rarely safe with white men. Resuming my walk along the road, little was seen save a few *Precis almana* of the wet-season form. I walked and walked, with many a glance back in vain hopes of seeing the car. Reaching at last the Galagedara Rest House I ordered food; while this was being prepared—consisting of tea, and nauseous bread, made, as is usual, with sugar instead of salt—the car arrived, but the chauffeur said it could go no further that night. There being no telegraph along that road the only thing to be done was to order a bullock hackery. After delays that seemed interminable the strange vehicle appeared. It may be described as a pair of wheels connected by a plank on which one has to balance one's self behind a diminutive bullock. It was eleven miles to Kandy, the first three up a hill that seemed unending, but the rest of the road was better, so that the little beast trotted intermittently, and, with liberal use of the goad and torrents of Sinhalese expletives, we made perhaps 3 miles an hour.

In this wise I returned, slowly, painfully, ingloriously, like a *chhota raiyat*,[1] where twelve hours earlier, I had dashed along a very *bara sáhib*.[2] In spite of the tropical moon and the fire-flies it was very dark under the palms. Late as it was—for it had taken the best part of four hours to cover eleven miles—we made a small detour to the garage. The proprietor forthwith sent out a sleepy chauffeur with a more powerful machine to go and tow back home the lame duck—made in Germany, be it said.

Haragama.

Four times I made the fatiguing pilgrimage to Haragama, twice alone, once with Mr. Green, once with Mr. Tylecote. It is a ten-miles drive and Kandy horses are not swift. Certainly, when seen under favourable circumstances, it is a wonderful place. My first visit was on January 20th; at 7 a.m. that morning at Kandy the thermometer had fallen to 65° F. Having had a small second breakfast I left the carriage at 9.30 a.m.; at that hour very few butterflies were on the move, but as I walked up the valley it got warmer and they gradually made their appearance. It was 3.30 p.m. before the carriage was regained, and with it food, and above all drink. For six hours I had walked under a tropical sun, a very task of Tantalus, to be for all that time within hearing of the brawling river the water of which I dared not so much as taste. A great part of the time I was walking under coco-palms, but could not persuade any

[1] Small farmer. [2] Great master.

of the few natives that were about to give me a green nut wherefrom to drink withal. No, the palms were all the property of a great native landowner, and they dared not pick a single nut.

It is strange that in a locality where the *Lantana* covered acres, I did not so much as see either *Danaida chrysippus* or *plexippus*. However, *Tirumala septentrionis* was not uncommon. *Parantica aglea* was comparatively scarce, at any rate only two specimens were brought home. *Crastia asela* was commoner than either of the other Danaines; a female specimen had suffered a remarkable unilateral injury whereby it had lost nearly all the hind margin of the fore-wing, and part of that of the hind-wing adjoining.

Neither did the Satyrines figure very largely in the living picture: *Nissanga patnia*, so abundant at Kandy, was quite scarce; of *Orsotriaena mandata* one female was taken; I have no note of *Yphthima ceylonica*, but can hardly believe that it was entirely absent.

A female *Euthalia vasanta*, Moore, found fluttering on the ground, had probably been trodden upon, a fate to which its habits may well lay it open. A worn male of *E. garuda*, Moore, was also taken. A tattered male of *Charaxes fabius*, Fabr., was drinking on damp sand, as was a male of *Charaxes* (*Eulepis*) *athamas*, Drury. The latter is a handsome species that apparently varies with the season; by a perverse ingenuity Moore concocted anagrams of the type name, and gave them to the different forms—*samatha* and *hamasta!* Of *Rahinda sinuata* I saw several; *Neptis jumba* was rather common, *N. varmona* abundant. *Precis iphita* was plentiful, but I saw no more than two *P. lemonias*, one of them, a male, was settled with half-opened wings. *Cupha placida* was common, it flies fast, looking on the wing mnch yellower than it is; it was once seen to orient with its wings half-open, but on another occasion to settle in the shade with its wings up. The bizarre *Cethosia nietneri* was almost common, one day I took three males within a few minutes, all at the same spot. I saw the female of *Cynthia asela*, and took several males. Wet sand attracted the male, *Lantana* blossoms the female of *Hypolimnas bolina*, she doubtless finding the latter sweeter and more fruity; the male of *Atella phalantha* was also thirsty. Both sexes of *Ergolis taprobana* were taken. On February 13th, I saw a *Limenitis procris*, Cram., race *calidasa*, Moore, at wet sand, and missed another at Lady Macarthy's Drive, Kandy, three days later.

Though a number of species of Blues were taken at Haragama, they could not be said to be very plentiful. Of many kinds but single examples were met with, viz. *Nacaduba atrata* and *Castalius decidia*; *Neopithecops zalmora*; *Megisba malaya*, Horsf.; *Cyaniris puspa*

and *Polyommatus baeticus;* the last four were all drinking at wet sand. In contradistinction to this very select assemblage, *Talicada nyseus* was present in great abundance. Mr. Green demonstrated to me the larva of this species feeding on the parenchyma between the upper and the nether epidermis of the fleshy-leaved *Bryophyllum calycinum*, Salisb. This plant is well known to those who are familiar with the forests of East or West under the name of the "Life Plant" from the fact that the leaves will produce roots. It is a member of the *Crassulaceae* and apparently of uncertain origin. Griesbach ("Flora of the West Indies") speaks of it as "an Asiatic Weed, ranging now from Mexico to Guiana"[1]; but Thwaites (*Enumeratio Plantarum Zeylandiae*) wrote: "Said to have been introduced." It is somewhat difficult to believe this latter statement, since we find the larva of a butterfly highly characteristic of Southern India and Ceylon living as a miner in its leaves. What did that larva feed upon before the plant was introduced? And how is it that the plant has two native names? If it were not so common where it occurs *T. nyseus* would be prized for its beauty and its singularity. A member of a family in which it is often most difficult to distinguish the closely allied species, it stands out by itself, unlike any other. It was twice observed to settle with closed wings and head up, but at once to turn round,[2] and was several times seen to move its hind-wings in the characteristic Lycaenid manner.

Other Blues met with were *Zizera indica*, of which one was seen sitting head down; *Everes parrhasius*; *Lampides bochus*, and *L. celeno*; none of these were common. *Castalius ethion* was, however, somewhat more plentiful, especially about wet sand. Several females of *Surendra quercetorum* were taken off *Lantana*; one of them was sitting head downwards.

There is no question that the striking feature of the Haragama butterfly fauna is the abundance of Pierines, an abundance that is quite remarkable. Before going into details it may be of interest to quote my notes as to the hour of appearance of different kinds of butterflies. "On February 13th I reached the bridge at 10 a.m., and found few butterflies about; the first *Hebomoia* put in an appearance at 10.30, it was abundant later; the first *Papilio parinda* was seen at 11 a.m., it was very common later, the first *Catophaga* was also seen at 11, but it remained comparatively scarce all day" (probably it was getting over, as there were still fewer on February 18th). Unfortunately I have no note of the weather, but have a note that

[1] I myself saw it in the Bermudas, in 1902, growing luxuriantly.

[2] See above, p. 114.

on that day very few insects were seen drinking. With this experience may be compared another: "Lady Horton's Drive, January 15th. Rained most of the day more or less, no true sunshine. *Yphthima ceylonica* moving about freely; they sat with wings fully expanded, but owing to lack of sun the question of orientation did not arise. *Nissanga patnia* abundant. It was hard to make *Orsotriaena mandata* come out into the open, but *Ergolis taprobana* was skimming about bushes, in spite of the rain. Several *Papilio aristolochiae* and one or two *P. pammon* seen. Three or four Whites were beaten out. There was heavy rain in the afternoon." Also a third day may be compared:—"February 5th, Lady Horton's Drive, 3.0–3.30 p.m. Many Lycaenids about, especially settled on the leaves of trees and shrubs. 3.30–4 p.m. Many *Crastia asela* and *Parantica aglea* flying slowly about."

Catopsilia pomona was fairly common. The brilliant *Ixias pyrene*, Linn., f. *cingalensis*, Moore, was only found at Haragama, where it was common almost to the point of abundance, but it flies swiftly and is by no means easy to catch. I brought home nine males and four females; all the former, but none of the latter, had a fairly distinct scent, which seemed to me to resemble closely that of Meadow-sweet (*Spiraea ulmaria*). A female was watched for some time and seen to settle thrice on yellowish leaves of *Bryophyllum*.

A still finer butterfly, *Hebomoia glaucippe*, race *australis*, though more than once seen by me at Kandy, is always associated in my mind with Haragama from its great abundance about the *Lantana*. When in fine condition it is a grand insect, but one that is hard to catch, moreover, worn specimens are common. On the wing the most conspicuous of butterflies, when settled with its wings closed the underside is remarkably cryptic, no orange is then exposed, but the general colour is suggestive of a faded leaf, an appearance greatly heightened by a "mid-rib" which is actually *raised*. This remarkable structure is no optical illusion, no mere effect of colour, but is due to a fold in the wing which is visible on the upper side; a similar dark raised line may be seen in the space below the median vein. The fact that this line is raised is noted by Moore, but was apparently overlooked by Bingham. Both sexes of this fine butterfly are endowed with a strong heavy scent which recalled that of the flower of the Mango. I took altogether ten males and three females.

Huphina nerissa, like its more gorgeous relative, though not confined to Haragama, was distinguished by its great abundance there. I took in all twenty-five males and four females, but could easily have got many more. The males had a decided scent, suggesting

that of our Small White, which—following Professor Image—I have all along compared to that of sweet-briar. *Nychitona xiphia* was rather common; I suspected a slight sweet scent in one specimen, but lay no stress on this observation.

The most numerous of all the butterflies was unquestionably *Catophaga paulina*; males greatly predominated over females, my takings being thirty-nine and six respectively, though the actual disproportion of the sexes seen must have been far greater. In phase they were all "dry," or at least "moderately dry." The males had a persistent sweet scent of the *Stephanotis* type; in one individual it was recorded as "extremely sweet." My note-book contains the following:—"Haragama, January 20th, about 1 p.m., saw numbers of males of *Catophaga*, all flying down the river, by ones or twos, but often three, four, or five together in strings. In the old spot by the bridge, where I had seen them four years before, were some twenty-five on the damp sand. With them were a male *Hypolimnas bolina*, a *Hebomoia*, a very few Blues, and some other things. When disturbed they would fly off and circle round, coming back to the favoured spots often five, six, or seven together, in strings, conforming to the movements of the leader, like wild geese." [See above, p. 118.] Again on January 30th I saw a dense cluster of butterflies sitting together on the sand, and popped my net over them; about half of them got away, but I found in my net thirty-eight *Catophaga*, four *Huphina*, and one *Hebomoia!* At a moderate computation there must have been altogether eighty butterflies. The same day I disturbed another cluster of perhaps about the same number, and with three sweeps of my net caught about a quarter of them, to wit, ten *Huphina*, seven *Catophaga*, and two *Ixias*.

Another Haragama Pierine, which if not so gorgeous as some others, is to my mind more exquisitely beautiful, is the pale blue, black-bordered *Nepheronia ceylanica*, Feld. This lovely creature, which should be seen alive to be properly appreciated, has the underside of a delicate bluish white with a silvery or shell-like lustre. During life its eyes gleam like olivines. It is rather common in the forest, is somewhat partial to shade, and has an aggravating way of flying right into bushes, indeed, save when on *Lantana* blossom, it is a hard butterfly to net. A female so seen was actually taken for *Parantica aglea*, of which it is a very fair mimic. The lovely male is far more often seen than its comparatively dull partner, my numbers are 14 : 2. Apparently both sexes have a decided, but not very strong scent, like that of *Freesia*. Mrs. Longstaff described the scent of a female as "slight frangipani."

The *Terias* taken at Haragama consisted of one *hecabe* (an intermediate male), seven *silhetana* (two "wet" males, two intermediate and two "dry"; as well as one dry-season female), and one *rotundalis* (a wet-season female).

But Blues and Pierines were not the only insects seen drinking at damp sand. Once I saw four *Papilio pammon* sitting all in a row; *P. telephus* was seen, but got away, then the glorious *P. crino* twice put in an appearance; though *P. aristolochiae* was fairly common, it did not seem to be thirsty; *P. agamemnon*, again, though common, preferred *Lantana* honey to water; a female *P. lankeswara*, f. *clytia* was mistaken on the wing for *Crastia asela*. A female *Ornithoptera darsius*, which had suffered a symmetrical injury to both hind-wings very suggestive of a bird's beak, had a decided musty straw odour, very different from that of a male, which suggested to my wife Rosemary, or rose-scented hair-oil, but to me it seemed more aromatic, suggesting Canada-balsam, or Sassafras. However, the *Papilio* most characteristic of Haragama is certainly *parinda*, a grand insect; the male was quite common, though the female was scarce. They are easier to catch in the afternoon than in the morning, though fewer may be seen. I feel sure that Mr. Millar of Durban was right in saying that, in the afternoon, though fewer butterflies are seen than in the morning, the proportion of females to males is much greater.

Skippers were conspicuous, if not exactly by their absence, at any rate by their rarity. A female *Parnara mathias*, a female *Iambrix salsala*, and a male of the neat black and white *Notocrypta feisthamelii* were all things that I had met with elsewhere that season, but not so the tawny brown and grey *Caprona ransonnetii*, Feld., which looked very pretty as it sat with widely spread wings; of this I took four specimens, all on February 18th.

One morning a native collector arrived on the ground just before me, and later in the day I happened upon his decoys, a *parinda* and a *glaucippe* pinned on to plants, as well as two *parinda* stuck into mud. I also got some evidence of the attractiveness of urine.

It is difficult to believe that Moths are as scarce at Haragama as snakes in Ireland, it is more likely that I was too much occupied with butterflies to look after them, but, be that as it may, four visits seem to have produced but two moths; a *Syntomis passalis*, Fabr., f. *montana*, Butl., and an *Aroa subnotata*, a male, taken flying quickly at about 3.30 p.m.

For similar reasons I found Beetles few and far between; single

specimens of *Mylabris orientalis*, Dej., *Telephorus dimidiatus*, and *Ichthyurus inermis*, Fairm., were netted on the wing, the latter has short yellow elytra; some Carabids of the genus *Omphra*, which were found under a stone, Mr. Arrow thinks may be *ovipennis*, Reiche (*in MS.*).

Hymenopterous society was almost equally select, being made up of single individuals of *Icaria ferruginea*, Fabr., the large steel-blue-winged *Salius iridipennis*, Smith, the black, yellow-legged *Sceliphron intrudens*, Smith, and the brilliant green Cuckoo-wasp *Hexachrysis oculata*, Fabr.

Two specimens of the Bombyliid, *Hyperalonia tantalus*, Fabr., represented the great order Diptera, while two *Plautia fimbriata* did the same for the Hemiptera.

Though Dragon-flies were abundant enough at Haragama, I never saw one catch, or even chase, a butterfly.

One day a native brought me a fine specimen of that strange creature, a *Phrynicus* sp. It is allied to the Scorpions, but its chelae, or pincers, are so long and slender that they might easily pass for the first pair of legs, whereas in reality the first pair of legs are extremely long, attenuated, and flexible, and would appear to function as antennae.

It was at Haragama that Mr. E. E. Green showed me the smallest of Snakes (one of the *Uropeltidae*), scarcely as thick as the pen-holder with which I write, and little if at all longer. The snake curled itself up in the palm of my hand, raised its head, and put out its tiny tongue. It lives in dead wood, pursuing in their burrows the beetle-larvae upon which it feeds. Truly, as Mr. Green said, the Tropics produce alike the largest and the smallest creatures. Another day, when splitting a rotten log with my hands, I disclosed another small snake (though somewhat larger than the first), but it got away. Again, the turning over of a sawn log exposed to view a Toad and a pretty little Mouse with a thin face and large ears.

After my first experience of motoring in Ceylon I had many misgivings about undertaking a longer expedition to Anuradhapura and Trinkomali. However, I was assured that a somewhat disreputable-looking Wolseley car was the most enduring of any in the island. It was not precisely silent; it had evidently had no paint or varnish wasted upon it since it left the manufactory, and everything that need not shine was dull. Nevertheless, handsome is that handsome does, and that car took me, my wife, and Miss Poole, the whole journey successfully. It was a non-stop run, for a faulty electrical connection that was put right in two minutes could scarcely

be called a break-down. Certainly motoring is *the* mode of progression for the Tropics. The car was of course covered, that is a necessity, and the rapid motion through the air made it difficult to realize the heat of the low country through which we passed. The entomological results, however, might have been better had we travelled in a bullock-waggon.

I have always urged that the irritation caused by the bites of insects is greatly increased by scratching, and that a little self-control will often lead to its rapid subsidence. But still more serious results *may* follow. We were going through a straggling native village when a small calf chose that occasion for strolling across the road; the car would have easily cleared it, but at the critical moment the calf stopped and leisurely licked the small of its back! The car gave a jump, and when I last saw that calf it was on its back in the middle of the road, with its legs straight up in the air as stiff as those of a Noah's ark beast that had been knocked over by a child.

Dambulla, 45 *miles* due N. of Kandy, 334 ft. above sea-level.

February 24th and 29th.

The huge, almost smooth, isolated black rock rises about 700 ft. above the plain. On one side it overhangs considerably, and this portion, enclosed by walls, forms the celebrated Rock Temple, now something over 2000 years old. In the dim light of the temple, beneath the painted ceiling we saw rows of solemn Buddhas of stone, wood, or plaster, sitting in cross-legged meditation. They were usually dignified, often impressive, as was certainly the colossal recumbent figure, 47 feet long, carved out of the solid rock.

We got an afternoon here for collecting on the outward journey, a morning on our return. The gorgeous *Papilio hector* was seen in larger numbers here than at any place, but *P. aristolochiae* was scarce. *Nychitona xiphia* was common, *Talicada nyseus* abundant. Here I found for the first time *Azanus jesous*, Guér., one of each sex, also *Catochrysops strabo*, Fabr., which was common, but all I took were of the male sex. It is sufficient merely to mention *Catopsilia pyranthe* (one), *Terias hecabe* (one), *T. rotundalis* (a male), *Lampides celeno* (one), *Tirumala septentrionis* (two), *Chilades laius* (two), *Zizera indica* (two), *Polyommatus baeticus* (one), and *Atella phalantha* (one); none of them were common.

Wet sand in the river bed and some tributary streams attracted a fair number of butterflies. *Catopsilia pomona* and *Catophaga paulina*

were in abundance, and among the others were a male *Charaxes fabius*, several *Tarucus plinius*, all males, as well as a male of the beautiful and very distinct *Curetis thetis*, Drury. In the bed of a small stream two or three miles north of Dambulla, I saw a *Papilio jason*, Esp. (*telephus*, Feld.) on the wet sand, struck at it, netted it, but with the same swoop netted also three *Catopsilia pomona*, one *Huphina nerissa*, and eleven *Catophaga paulina!* Numbers of the little *Nacaduba ardates* were about a tiny puddle in the path.

The only moths met with at Dambulla were the day-flying *Deilemera coleta* and the Geometers, *Alana capitata*, Walk., and the purplish-grey *Timandra mundissima*, Walk., the latter in the rest-house at night, where it was accompanied by the Chafer *Phyllognathus dionysius*, Fabr. The Elater *Melanotus hirticornis* was clinging to the mosquito-curtain of my bed, having been in all probability attracted by light the night before. Inside the same curtains I found the Pentatomid bug *Megymenum brevicorne*, Fabr., a tuberculated brown creature with short flat antennae; whether this insect had merely taken advantage of a convenient resting-place, or whether he had an evil design upon the writer, I am unaware, but if the latter, all I can say is that he was anticipated. A few other bugs whose actions were less open to suspicion were the brilliant scarlet and black Reduviid, *Sphedanolestes nigro-ruber*, a rare insect; another Reduviid, the handsome, large, shining, blue-black *Physorrhynchus linnaei*, Stål, which has the underside and the margins of the abdomen brilliant scarlet, the antennae of the male are hairy; it exhales a pungent acetic odour, quite unlike that so commonly met with in Pentatomids. I found my specimen under a log. Yet another Reduviid, *Velitra rubro-picta*, Am. & Serv., was found under the bark of a log in the compound of the Rest-house; it is a somewhat variable bug, my specimen lacking the usual red pigmentation.

A few beetles were turned up from under logs: the Tenebrionids, *Pseudoblaps clavipes*, Walk., and two specimens of another species of the genus; a Carabid of the genus *Omphria*; *Platysoma desinens*, Walk., and *Taeniolobus* sp. Mrs. Longstaff found a specimen of *Trachypholis hispidus*, Web., near the Rock Temple. I also came across the Phytophagid, *Apophylia pallipes*, Jac.,[1] and the plant-eating Ladybird, *Epilachna indica*, Muls. A native child brought me a living specimen of the large, brilliant, metallic, emerald-green *Sternocera sternicornis*, Linn.; it is a well-known Buprestid which I feel sure that I had seen more than once in Lady Horton's Drive;

[1] I had heard of Martin Jacoby's death from Mr. Green but a few days previously. Shortly before sailing I had promised to get him some Phytophaga.

it was very conspicuous on the wing, but never came within reach.

Of the Hymenoptera the most conspicuous was *Xylocopa tenuiscapa*. A flowering shrub was especially attractive to Bees, including plenty of *Apis florea*, Fabr., var. *andreniformis*, Smith, a *Ceratina*, and a *Prosopis*; I took also one of the blue bee *Podalirius zonatus*.

The most interesting Dambulla insect was *Scelimena logani*, Hancock, of which my wife caught the first specimen when fishing for Water Snails in a swift but shallow stream. This is a genuine Water Grasshopper, or rather amphibious grasshopper. It flies in the sun readily enough for two or three yards, and, when it alights on rock or sand at the water's edge, is by no means easy to see, being exactly the colour of its surroundings; it is, however, easily caught when detected. When it takes to the water it swims beneath the surface with a series of jerks, each stroke carrying it but a short distance, recalling a Water-boatman (*Notonecta*), though it does not swim on its back as they do. Examination proves the hind tibiae and tarsi to be flattened out so as to form jointed oars. [See Fig. 13; also Plate IV., Fig. 13.] Mr. H. Knight pointed out that the blade of the oar strikes the water with a concave surface as the insect kicks out, whereas in recovering a convex surface is presented to the water. Mr. Shelford informs me that the nearly allied *Gavialidium crocodilus*, Sauss., has hind legs of the usual structure. I subsequently came across *S. logani* in a small stream close by the Rock Temple at Hindugala, two miles south of Peradeniya, but not in such numbers as at Dambulla.

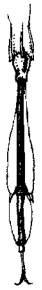


FIG. 13.—Leg of Water-Grasshopper.

ANURADHAPURA, 86 miles (by road) N. of Kandy, 278 ft. above sea-level.

February 25th and 26th, 1908.

The road from DAMBULLA to ANURADHAPURA leads through a very sparsely inhabited jungle. In ancient times the land was irrigated and under cultivation, but the irrigation works were allowed to fall into decay, and Nature resumed possession, as a consequence it is now covered with a forest of secondary growth. The trees are of very moderate size, there are practically no palms, and there is little save a general untidiness to suggest the tropics. Houses are miles apart and very few people are met with, the only vehicles being the picturesque covered bullock-carts.

Flowers are but little more obvious than human beings, and a large part of those seen are weeds introduced from America. Such of the ancient tanks as still hold water are covered with Water-lilies. From time to time one gets a glimpse of long-tailed Monkeys, and one of them in its terror almost fell into the motor. The Golden Oriole, and other brightly coloured birds, blue or green, now and again fly across the road, but the bird that interested me most was the Jungle Fowl (*Gallus bankivus*, or possibly a closely allied species), the reputed ancestor of our various breeds of domesticated fowls. The cock is in general colouring very like a game-cock.

The most remarkable thing about Anuradhapura is the vast extent of the ruins. They reach for miles into the forest. The great bell-shaped Dágobas, about as big as St. Paul's, rank first in magnitude, but I admired more the countless granite monoliths, of which there must be many thousands. These monoliths are for the most part square, often ornamented in the upper portions and usually bearing capitals; of somewhat slender proportions they range from 8 feet or 10 feet to upwards of 25 feet in height. Many of them lean in a manner which is surprising until one learns that they are pushed out of the vertical, and held in the oblique position by masses of tree-roots, for Anuradhapura has been a deserted city for over a thousand years during which the forest has reigned supreme. Its most important buildings are upwards of 2000 years old. Apart from the main show-places, it is strange to see in all directions these monoliths standing in the tangled forest, and occasionally a solemn figure of Buddha, still meditating, teaching, or "renouncing the world." The priests in their flowing yellow robes of almost classic fashion, as they move quietly about the ruins serve to connect the remote past with the present, for to Buddhists this is very holy ground. Dr. J. C. Willis, the Director of the Royal Botanic Gardens at Peradeniya, seems to think that the much venerated Bo-tree may quite possibly be the original tree, which in its turn grew from a branch of that under which Gautama attained Buddha-hood, at Bodh Gaya in Northern India. That branch was brought to Ceylon in 288 B.C. Even so it would not be the oldest known tree in the world, for the Tree of Confucius dates back to 500 B.C.

The part of the ruined city that found most favour with butterflies was the pavement round the Abhayagiriya Dágoba. In India I had learned to associate ruins and the genus *Teracolus*; it was the same here, the species in charge, which was quite common, being *T. amatus*, Fabr. (*modestus*, Butl.). These pretty butterflies were decidedly of the "wet" phase, the females were almost equally

divided between the pale form and the reddish form. I have often found *Ixias* associated with *Teracolus*, but here found but a single male *marianne*, Cram., of intermediate "dry" phase, though *Huphina nerissa* was distinctly "wet." Other butterflies were a male *Catopsilia crocale*, a male *Delias eucharis*, a few *Danaida chrysippus*, *Zizera indica*, and *Catochrysops strabo*, with single specimens of *Precis lemonias* (dry-season form) and *Parnara colaca*.

Two species of *Podalirius*, hovering as usual, were also as usual hard to catch, viz. the blue *P. zonatus*, and the violet-black, *Xylocopa*-like *P. violaceus*, Lepel.; the only wasp was the small yellow *Eumenes esuriens*, Fabr. On the flowers of Vervain were two black and red *Mylabris*, the large *M. pustulata*, Thunb., and the small *M. thunbergi*, Billb. A few Carabids of the genus *Omphra* were found among the ruins. Among some dead snail-shells Mrs. Longstaff found a specimen of *Ethas carbonarium*, Pascoe.

The Rest-house lights were not so attractive as might have been expected, the neat but solitary Pyrale *Sameodes cancellalis*, Zell., having as its only companions the Scarabs, *Copris repertus*, and *Catharsius pithecius*, Fabr., f. *crassicollis*, Walk., three, and a species of *Encyalesthus*, not in the British Museum, which was actually too hard to pin.

I went one morning about four miles along the Trinkomalí Road which goes through the forest. Speaking generally butterflies were not common or remarkable: *Danaida chrysippus*, *Precis iphita* and *lemonias*, *Hypolimnas misippus* (a species that I did not see elsewhere in Ceylon), *Yphthima ceylonica*, *Mycalesis mineus*, f. *polydecta*, the "dry" phase; *Papilio pammon*, and *P. telephus*; *Zizera indica* and *Z. gaika*; *Catochrysops cnejus*, Fabr.; and *Terias hecabe*, two males, one "wet" and one "dry." A male Lithosiid, *Nishada flabifera*, Moore, was seen to settle upon a leaf.

When I say that butterflies were not common I must make an exception in favour of *Catophaga paulina*. Mr. John Pole had told me that if I could find a damp place where bullocks had halted I should be sure to find numbers of butterflies there; he said the butterflies were attracted by the ammonia. I *did* find such a place, and sure enough there was a patch of white butterflies about five feet long! Sweeping my net along them filled it with a rustling crowd of at least 50 *C. paulina*. Along with the Whites were odd specimens of *Crastia asela* and *Narmada montana*.

The old flight of moss-grown steps through the forest up to the temple at Mihintale had quite a romantic charm that greatly affected us. Though there was little time or opportunity for collecting, I

took, or at least saw, *Papilio hector*, *Nepheronia ceylanica*, *Catopsilia pomona*, *Nissanga patnia*, *Zizera gaika* and *Lampides celeno*, as well as the metallic-green Bug, *Chrysocoris stockerus*. Mrs. Longstaff, while hunting for snails at the bottom of the steps, found among dead leaves a dark metallic-blue phytophagous Beetle, *Corynodes dohrni*, Baly, as well as a luminous beetle-larva (? apterous female). This insect used the last segment of the abdomen in walking as a "clasper," somewhat like a Geometer larva, or a leech. On the underside of the penultimate segments it exhibited two constant green lights. In the centre of each was a black non-luminous spot. When put into the cyanide-bottle the lights were almost instantly extinguished.

Fire-flies always interest me, and although out of the order of the narrative it may be convenient to record here some observations made at Kandy.

January 21st, 1908. *Luciola* (?) *vespertina*, Fabr.,[1] a female, taken at light in the hotel. When first captured it was flashing at the rate of about 120 to the minute. On being chloroformed the light at once became constant, but in a minute or two was extinct.

January 24th, 1908. A fire-fly, *Luciola vespertina*, Fabr., came to light. When disturbed it gave forth an intermittent light at the rate of from 60 to 90 flashes to the minute, possibly sometimes even more rapidly, but it declined to flash for many seconds together, so that it was not easy to measure the rate. It was put into the cyanide-bottle, and as soon as it appeared to come under the influence of the poisonous vapour, and before it ceased to move its legs, the flashes gave place to a continuous light. This was fairly bright after fifteen minutes, but when looked at after the beetle had been thirty minutes in the bottle the light was found to be extinct.

January 25th. A fire-fly, *Luciola vespertina*, flashed very irregularly. When running about in the box the flashes followed at fairly regular intervals, but when the insect stopped the light was extinguished. I actually counted 29 flashes in one minute, but the rates measured for shorter periods (quarter to half a minute) worked out at 36, 36, 44, 24, 28, 32, 36 per minute. It occurred to me that possibly the rapidity of the flashes might be proportional to the rapidity of movement of the legs or wings. When put into the cyanide-bottle the light was extinguished almost immediately.

January 28th. Two fire-flies, *Luciola vespertina*, came to light.

Fire-fly A was very active; four counts gave the rate of pulsation

[1] This lacks the black spot on the elytra, and Mr. C. J. Gahan thinks that it may possibly be distinct.

of the light as 100, 104, 90, 86 per minute. It was then put into the cyanide-bottle; in about half a minute, before the death of the insect, its light became constant; in four minutes the light was very faint, in five minutes it was extinct.

Fire-fly B was also very active; four counts gave the rate of flashing as 116, 122, 106, 102 per minute. It was then chloroformed; within about twenty seconds the light had become almost constant, in three minutes it was faint, in four minutes extinct.

A short halt some 25 miles short of Trinkomalí, in a delightful part of the forest, where the trees were much finer than usual and the roadside grass of more interesting character, yielded only *Crastia asela*, *Tirumala septentrionis*, a male with a pleasant scent, and a "wet" *Terias hecabe*. Grubbing among dead leaves unearthed the brilliantly shining Phytophagid beetle, *Corynodes dohrni*, and a second specimen, an apterous female, of the fine scarlet and black shining Bug *Physorrhynchus linnaei*; it has remarkably thickened fore femora, and a fetor of its own.

TRINKOMALÍ.

February 27th, 1910.

TRINKOMALÍ is very beautiful, and we saw it under the best of weather conditions, alike during an afternoon walk round Fort Frederick and an evening row in the lovely harbour; but the whole place is wrapped in an air of gloom the impression of which has not yet worn off.

Fort Frederick is entered by a fine gateway forming part of the old Dutch works; just inside will be seen the date 1676, but it was not captured by us till September 1795, and the Royal Arms must have been set up later still. As I entered a native policeman saluted me; he and one other native seemed to make up the garrison. The fine ranges of barracks looked forlorn in the extreme; a notice, "this water to be used for washing only," seemed to grin mockingly at the visitor. In a singularly beautiful retired corner under the shade of a group of trees stood a row of tomb-stones marking the last resting-place of some of the Dutch officers of the quite old days. In an ancient battery close by were a couple of 32-pounders bearing the monogram "G.R." A 9-inch muzzle-loading rifle-gun, an obsolete weapon of the mid-Victorian epoch, set on end in the ground formed a seat. On every hand the remains of turn-tables and rotting

gun-carriages were to be seen. At the highest point was a naval signalling station still rigged with yards, blocks, and halyards, but there was no flag, no one in charge; one missed the neatly dressed man with a telescope, the respectful salute, the cheery gossip, and wondered listlessly how long it might be before the halyards would rot and the yard would fall. A few paces further, at the point, lay the latest instrument of destruction, a "9·2." But it had no breech-piece and no elevating gear; each end was plugged with wood, its muzzle propped up by a baulk of timber. I suppose it had cost the British tax-payers over £10,000 to make that gun and place it there.

An exceptionally fine Palmyra Palm must have seen many changes since it first raised its proud head, at least a century ago. Two half-tame Deer wandered about in peaceful possession, waiting for the time when the rapidly invading jungle should have driven away all recollection of their old masters, from whose hands they had doubtless often taken food.

A solitary Dove was an appropriate living symbol of the changed times, and the only warlike thing still in commission was the Spear-grass.

Doubtless ere long Fort Frederick may afford quite good collecting, as it was I found *Papilio hector* where I should have seen a signal-man, and *Catopsilia pyranthe* appropriately enough fast asleep close by; several Blues—a female *Tarucus theophrastus*, Fabr. (the only one seen in Ceylon), a male *Azanus jesous*, a female *Zizera lysimon*, a male *Catochrysops strabo*, and a female *C. cnejus*. Then there were *Telchinia violae* (it was just the sort of place it likes), *Yphthima ceylonica* and quite a number of *Teracolus amatus*. On a wall of a deserted building was a delicate greeny-blue Wasp, *Sceliphron bengalense*, Dahl.

To me there is always something inexpressibly sad about abandoned military works, especially if they be in a remote part of the world. One thinks of the brave men of old who attacked or defended them, performing deeds of heroism now totally forgotten. Certainly the makers of treaties and framers of policies never think of those men.

Exceedingly sorrowful and depressed I walked across the Maidan to the Rest-house, distinguished from all others by a flagstaff smartly rigged in man-o'-war fashion. Its large dining-hall is covered with photographs of Naval Officers and ships-of-war, with heads of deer interposed here and there. The wizened old Rest-house keeper, "Tamby" by name, and his still older waiter, who had both attended

to the wants of generations of sailors, looked woe-begone to the last degree, for had not their glory altogether departed? Tamby said to me wistfully, "You know, master, when they come back?" Alas! I did not know. So far as I am aware the only other guest of Tamby's that night was a male *Hyperlopha cristifera*, Walk., a Noctuid in which the sexes greatly differ.

Soon after our arrival the Rest-house was invaded by an army of Box-wallahs, who at once besieged us with shells, sharks' jaws, skins of leopards and pythons—with all the things, in fact, which had found a ready market in the squadron; the men were sorrowful and looked really hungry. After some trifling purchases I said to them, "You had better go away and pray to Muhammad for the sailors to come back." They quite understood and smiled sadly.

Then there are the trim Admiralty buildings in tidy rows along the shore of the harbour, a harbour alike beautiful, safe, commodious, and easily defended.

That part of Admiral Fisher's policy of concentration which led to the abandonment of "Trinko," among other outlying stations, *may* have been wise, but I incline to agree with those who, realizing that modern ships are far more dependent upon dockyards in war time than were the "wooden walls," look upon the abandonment of this place—the only good harbour in Ceylon—as an act of madness which may in the future cost the nation dear.

Habarane.

On our return journey to Kandy we made a mid-day halt at Habarane, a very English-looking place in the heart of the forest, in hopes of finding something new, a hope that was not justified. A number of butterflies were observed but they were members of the Old Guard. *Crastia asela, Tirumala septentrionis, Parantica aglea*; *Precis iphita, Ergolis taprobana* and *ariadne, Cethosia nietneri*, a *Neptis*; *Zizera otis, Lampides celeno*; *Catopsilia pomona* and *pyranthe, Terias hecabe, Catophaga paulina, Huphina nerissa*; *Papilio telephus, P. hector, P. aristolochiae, P. parinda, Ornithoptera darsius*; and *Iambrix salsala*. With these were the common *Chrysocoris stockerus*, and the wasps *Sceliphron bengalense* and *Eumenes flavopicta*, Blanch., the last having a U-like mark on its thorax.

Hatton.

March 3rd—10th, 1908.

Hatton, lying just below Kotagala, or The Duke's Nose, a prominent mountain which forms a conspicuous object from many points on the railway, is a chief town of the tea-country. Kotagala is capped with a surviving patch of forest: it was in its dampest glades that I made my first intimate acquaintance with the dread Land Leech: a restlessly active, pushing, over-familiar, blood-thirsty animal that I never wish to see again.

A few things came to the lights of the hotel; the Boarmiid, *Tephrina parallelaria*, Walk.; the Pyrale, *Bostra castanoptera*, Moore; the Crambite, *Poujadia inficita*, Walk.; the tiny white Hydrocampid, *Mixophila renatusalis*, Walk. (*Crambus ermineus*, Moore) and the Chafer, *Anomala walkeri*, Arrow.

Xylocopa tenuiscapa, a female, turned up in our bedroom, but that I presume was an accident.

In or about the hotel garden I took *Terias hecabe* and *T. libythea*, also a female of *Pademma sinhala*, Moore, which had an acetic odour. A very old friend was also there, *Pyrameis cardui*, an insect that I had not met with in Ceylon previously. The two-tailed Geometer, *Epiblema obscuraria*, Moore, spread out upon a dark stone closely resembled in colour a piece of lichen.

In the tea-gardens between the hotel and the forest *Catopsilia pomona*, *Catophaga paulina* and *Argynnis hyperbius*, Johanns. (*niphe*, Linn.) were occasionally to be seen. It was noted at the time that though the male *hyperbius* looked on the wing like the Fritillary that it is, its female was actually netted for *Danaida chrysippus*. In the drying-house a *Hister* was found under wood. A fly, *Rhinia* sp., frequented the flowers of the tea plant.

Naturally enough I spent most of my time in the forest, and this in spite of the haunting terror of leeches. The summit of Kotagalla is perhaps 1000 ft. above the hotel; one day I climbed up for some distance, but as insects got less and less common with the altitude, was not encouraged to persevere. The only Danaines met with were *Crastia asela* and *Chittira fumata*, Butl. (*taprobana*, Feld.), neither of them in any numbers, but the latter interested me inasmuch as I thought I saw it in the same place in 1904.[1]

The only Satyrs were single examples (both females) of *Lethe drypetis*, Hew., and *L. daretis*, Hew. (though at least one other of

[1] See p. 118.

the latter was seen), both of them species which I had taken in the same place previously.[1] It is somewhat remarkable that on neither visit did I see *Yphthima ceylonica.* A few *Neptis varmona*, *Atella phalantha*, and *Precis iphita* were observed and one *Hypolimnas bolina*, while *Limenitis calidasa* sat on a leaf high out of reach. The Blue Admiral, *Vanessa haronica*, was very decidedly cryptic when settled on the bare mottled, purplish-grey rocks, and by no means easy to capture, but after some manœuvring up and down the bed of the stream I at length secured a specimen.

The commonest Blue, especially near water, was *Cyaniris singalensis*, Feld. (which Bingham regarded as a race of *huegeli*, Moore); they were all males, and several of them had a sweet scent, but not of the chocolate-vanilla type, common to so many Blues. Of *C. limbata*, Moore, I took but one, not distinguishing it at the time from the preceding. Curiously enough I do not seem to have met with any Lycaenids other than these two.

Catopsilia pomona was decidedly common, once more showing a partiality for the blue flowers of Vervain (*Stachytarpheta*); the only other Pierines were *Terias hecabe* and *silhetana*, which occurred in about equal numbers.

Several examples of *Papilio teredon*, Feld. (regarded by Bingham as a race of *sarpedon*, Linn.), were seen; it was noticed that they did *not* flutter when settled on damp sand; a single *P. parinda* and one or two *P. agamemnon* also put in an appearance. But the *Papilio* characteristic of Hatton was unquestionably *P. helenus*, Linn., f. *mooreanus*, Rothsch., which was almost common along the stream. Its scheme of colour, black with a squarish cream-coloured patch, is chaste and effective; its flight was somewhat wild, but near the Tamils' drinking-place a couple were netted sitting quite close together. On another occasion three were seen drinking together, their wings but three-quarters open, so that the cream-coloured spot on the hind-wings was entirely concealed and they appeared to be black uniformly. This species flutters when drinking.

But though this *Papilio* was the biggest thing I took at Hatton, it was not the best, for the very dark, almost black Skipper, *Hantana infernus*, Feld., is distinctly rare; it is (for a Skipper) a slow flyer, and I secured three specimens which were all seen to settle on the underside of leaves with wings fully expanded. The only other Skippers actually captured were *Notocrypta feisthamelii*, which settled with its wings up, and a female *Celaenorrhinus spilothyrus*, Feld. The latter is a conspicuous insect with a moderately quick flight; it

[1] See p. 116.

settled under a leaf; there can be no doubt that this habit is an effective mode of protection. Another large black Skipper, similarly concealed, was netted, but managed to get away. The same day the handsome *Tagiades obscurus* (*distans*, Moore) was seen settled on the *upper* surface of a leaf with wings expanded; on a previous occasion a *Hantana* settled on the *upper* surface of a leaf of a Bramble, *Rubus rugosus*, Smith, the prickles of which made the butterfly's position unassailable.

The Pyrale, *Pachyzancla phoeopteralis*, was locally abundant by the stream. The handsome Tineid, *Timyra crassella*, Feld. & Rog., came to light; it resembles our *Phibalocera quercana*. The Oecophorid, *Psaltica monochorda*, Meyrk., was taken in the forest and in a tea garden.

The only Aculeate was an undetermined *Cerceris*. On the other hand, Flies were comparatively numerous: *Rhinia discolor*; a rubbed *Anthrax*; a brilliant green *Psilophus*, with a coppery spot on its abdomen, not represented at South Kensington; the Syrphid, *Asarkina ericetorum*, Fabr.; and a Tabanid *Haematopota unizonata*, Ricarde, which attacked me one dull afternoon just before rain.

Turning over stones and logs in the forest, more especially in damp places, proved a perilous employment, which indeed the Leeches finally forced me to abandon. These things are difficult to explain, but it is a fact that I am more frightened of ticks and leeches, insignificant though they appear, than I am of venomous serpents. The latter can be put to flight, but the smaller and more insidious foes know no fear.

The Beetles found were a Tenebrionid, a species of *Ulma*, together with the Passalids, *Chilomasus comptoni*, Kaup., and an unnamed species of the same genus. I found upon my net a slender red and black Longicorn, an *Oberea*, represented in the British Museum, but undescribed. The Cetoniids, *Clinteria pleuronota*, Blanch., and *Popillia complanata*, Newm., were taken flying about flowers or shrubs. Somewhere and somehow at Hatton, for I cannot speak precisely, I got a specimen of the Melolonthid, *Lachnosterna cingalensis*, Brenske. The brilliant *Chrysocoris stockerus* turned up again.

At the Devon Falls, *circa* 4000 ft. above sea-level, and 10 miles west of Nuwára Eliya, I took nothing remarkable: *Neptis varmona*, *Talicada nyseus*, *Delias eucharis*, *Terias hecabe*, and *Telicota bambusae*.

At Nanu Oya station, 5300 ft., a pale yellowish-brown phytophagous beetle, *Lema yerburyi*, Jac., flew into the train.

BANDARAWELA, *circa* 4000 ft. above sea-level.

March 11th—14th, 1908.

The railway journey from Hatton to this place is one of marvellous beauty. The train, after running for many miles through tea-gardens, enters the primaeval forest near the Horton Plains, a most fascinating region but little disturbed by man, where the Rhododendrons catch the traveller's eye, not lofty trees as in the Himálaya, but rather having the character of big shrubs. The train then enters a short tunnel under the ridge of the mountain, to emerge in quite a startling manner: there is a complete transformation scene. One finds one's self high on the side of a steep mountain range, with a rich plain spread out at least 3000 ft. below. This plain is almost enclosed by hills which are highest on the side taken by the train.

At BANDARAWELA there are tea-gardens on the higher ground, but between them and the river is a wide stretch of grass land having a down-like character. There is but little wood, though there is a swamp not far from the town.

As at Hatton so here *Yphthima ceylonica* was conspicuous by its absence, but I was pleased to catch a specimen of the very distinct *Y. singala*, Feld., an endemic species. I also took one *Mycalesis perseus*, Fabr., an "intermediate tending to dry" female, and saw others; I did not meet with this species elsewhere in Ceylon. Several *M. polydecta* were seen, but they were difficult to catch, owing to their habit of keeping close down among the vegetation, whence they are dislodged with difficulty. I secured one of each sex, both more or less "dry"; when the pencils of hairs on the wings of the male were exposed a strong burnt-sugar odour was clearly perceptible. A female of *Lethe rohria*, Fabr., race *nilgiriensis*, Guér., a butterfly of slow flight, was seen settled on the ground in an open place near water.

Neptis varmona was rather common, and a few *Precis iphita* and *orithyia* were noted. Late one windy afternoon on a bare and exposed hill-top a solitary male *Pyrameis cardui* was found haunting the cairn that crowned the summit; it was just the sort of spot that the species loves all the world over, and, as usual, when disturbed it returned to its post again and again; both its hind-wings had suffered loss, apparently by the mouth of a lizard. I was somewhat surprised to take a female *Cethosia nietneri* halfway between Bandarawela and the river on the Welimada path.

Danaines were not numerous, single specimens of four species were met with: *Danaida chrysippus*, a small female; *Narmada montana*, a female, on the top of a grassy hill rising from the plain, not at all the *locale* that suggests that insect; also *Parantica aglea* and *Crastia asela*.

Some of the Blues which were abundant at Kandy were scarce at Bandarawela, such for instance as *Lampides celeno* and *bochus*; some were common enough at both places, such as *Polyommatus baeticus*, *Zizera otis*, and *Everes parrhasius*. On the other hand, this was the first place in which I came across *Spindasis vulcanus*, Fabr., and *elima*, Moore (? *ictis*, Hew.), the former not uncommonly; it has a curious rapid curvetting flight close to the ground.

The Pierines were not numerous: *Catopsilia* just put in an appearance, as did several *Delias eucharis*, but *Terias* was in abundance including both typical *hecabe* and *libythea*; the last was commoner here than elsewhere, being indeed the dominant Pierine of the locality. It was a matter of great interest to me to detect a sweet scent in the male of this species, all previous observations on Oriental *Terias* having yielded negative results; the interest was increased by the fact that the scent was definite and distinctive, being compared at the time to that of Pink Bindweed (*Convolvulus arvensis*), and indistinguishable from that found by me in several West Indian species of the genus.[1]

A few *Papilio parinda* were seen, and I think also one *P. pammon*.

The small grey, fly-like Skipper, *Taractrocera maevius*, which I had also taken at Kandy was commoner here, but *Baracus vittatus*, Feld., a swamp-loving species also common at Bandarawela, did not occur at Kandy, being confined to the higher ground.

The finest Moth met with was unquestionably *Choerocampa theylia*, Linn., which came to light together with *Siccia taprobanis*, and *Tephrina parallelaria*. The last-named was also kicked up by day, being very common in the afore-mentioned swamp which also yielded the Gelechiid, *Timyra irrorella*, Wlsm. The Noctuid *Amyna natalis*, Walk., was found under a stone when looking for beetles.

Two males of *Xylocopa tenuiscapa* were secured by watching a hole about two feet from the ground, in a dead portion of a solitary tree.

Two examples of a *Chlaenius* not in the British Museum were found under stones; *Mylabris pustulata* was taken on the wing, as was *Anthrax* sp. A Bug with long spines on its shoulders that would appear to be *Cletus elongatus*, Dohrn, was taken in the swamp, it is a species hitherto unknown to Mr. Distant.

[1] See below, pp. 509, 510.

ELLA, 3250 ft. above sea-level (8 miles from Bandarawela).

March 13th, 1908.

If the view from the World's End is positively awe-inspiring, and that from the mouth of the railway tunnel so startling as almost to take away one's breath, that from the Rest-house at Ella is picturesque in the highest degree.

A gap between two mountains affords an outlook over the palm-groves on the plain, which loses itself in the soft blue distance where lies the sea some fifty miles away. A waterfall in a wooded gorge that cleaves the rugged mountains on the right gives an almost theatrical completeness to the scene. It is altogether a place at which we would gladly have stayed for days instead of hours.

Yphthima ceylonica, not to be found in any of the higher country, was here fairly common, it was accompanied by *Mycalesis polydecta*. One *Precis orithyia* and one *P. iphita*, a male, were all that I saw of the genus; *Neptis varmona*, *Atella phalantha*, and a solitary *Ergolis taprobana* were the only other Nymphalines, as *Crastia asela* was the only Danaine.

The common Blues of the place appeared to be *Everes parrhasius* and *Zizera otis*, while on the scarlet flowers of *Woodfordia floribunda* Salisb., I took a second specimen of *Spindasis elima*, from which some foe had symmetrically removed the anal angles of the hind-wings together with their appendages.

Terias libythea and *hecabe* were both common. There were a few Papilios about, the only one that came within reach being *aristolochiae*.

Aroa subnotata flew swiftly along the road at 2 p.m. The Dung-beetle, *Copris sodalis*, Walk., and some Ants were found under stones.

NUWARA ELIYA, 6210 ft. above sea-level.

March 14th and 15th, 1908.

As in all properly constituted "Hill Stations" in the East, Nuwara Eliya centres in a racecourse. There is no doubt about the Briton carrying his civilization with him in an open, not to say assertive, way. The whole district constitutes one vast park, but this has not checked the introduction of the Eucalyptus, Wattle, and other Australian trees, as well as the Californian *Cupressus macrocarpus* and the more humble Gorse—all of which seemed to me singularly out of place, jarring notes in the landscape. It must, however, be

admitted that the anglicizing process has been very complete in Nuwara Eliya. Even the well-kept church with its trim flower beds has quite an English look, inside and out. The seven windows in the apse, filled by a fine series of designs by James Powell,[1] give a cool, soothing, green tone to the interior, constituting one of the most successful pieces of modern decoration that I know.

Nuwara Eliya has perhaps a Scottish rather than an English look, and this was intensified by the little monsoon which brought deluges of rain each afternoon.

At the times of my two visits, in 1904 and 1908, this locality struck me as an entomological desert, but I feel convinced that at other times of the year it must be more productive.

The top of One-tree Hill, a few hundred feet above the hotel, was the most productive spot I reached. This was the only place in Ceylon where I met with *Pyrameis indica*, Herbst, of which I saw several, one much battered. Its flight is quicker than that of our Red Admiral, but less graceful. *Argynnis hyperbius* was common on the same ground. *Cyaniris lanka* and *Polyommatus baeticus* helped to keep the place lively, as did *Baracus vittatus*, though the grass had no claim to that swampy quality which that Skipper seems to love. A few *Chittira fumata* and *Terias hecabe* turned up, as well as a pretty Gelechiid, *Tipha brochias*, Meyrk. I spent some time over a large Fly, a species of *Dexia*, a noisy creature which was hard to see flying in the sunshine, but easy to capture when settled on "Nelus" (the general native name of the rank undergrowth), whenever the sun was covered by a cloud. I secured 4 ♂ and 1 ♀, and found that the National Collection had 2 ♀ only, from Ceylon, unnamed. Three Passalid beetles of the genus *Chilomazus* were found under a log. The Heteromeron, *Apogonia coriacea*, Waterh., and a large specimen of the Lithosiid, *Asura solita*, visited the hotel lights.

A visit to lovely HAKGÁLA was spoiled by deluges of rain; the slow-flying *Chittira fumata* was dancing about round the Vernonia at the old spot a little above the entrance to the Botanic Garden.[2] *Cyaniris lanka* and *Chilades laius* occurred close by. An *Anomala* (Lamellicorn) was taken flying in the sun, and Mrs. Longstaff found at the roots of grass a very striking Chrysomelid, *Sphaerolina templetoni*, Baly; it has a metallic blue thorax and elytra like new mahogany.

We steamed up the Malabar Coast in perfect weather in the

[1] I recognized the hand of this artist at the first glance.

[2] See above, p. 118.

P. & O. ship "Delta," the most commodious and by far the cleanest vessel in which I have sailed. Commander Daniell (an old shipmate in the "Malta") is a fine example of the merchant seaman, moreover a jovial follow, and a good performer in the music-room.

When in lat. 14° 20′ N., Long. 73° 50′ E., off the coast of Goa, the ship passed through a sort of scum; it was in patches from a dozen yards to a furlong or more across. It was evidently very light, floating on the surface, varying in colour from sulphur-yellow, through greenish, to a dirty brown. There was much discussion on board as to its nature. When some of the surface water was fished up, the unknown substance was seen to rise to the surface very quickly. The strongest pocket lens available showed it to consist of particles all nearly the same size and somewhat resembling saw-dust. A very confident opinion was that it was chopped up, or pulped bamboo. My own view inclined to a lowly vegetable organism, some kind of Alga, and I suggested that the sulphur yellow was alive and growing, the brown dead or dying. This scum must have extended, with intervals of clear blue water, for several miles.

A specimen was ultimately submitted to Prof. Sydney H. Vines, F.R.S., who reported: "It is one of the blue-green Algae (*Cyanophyceae*, or *Phycochromaceae*, or *Myxophyceae*), belonging to the family of the *Oscillariae*, though I have not been able to determine it specifically." He added that it was allied to the organism which sometimes covers small lakes in England and Ireland with a dense scum: this after a time breaks up and disappears—a phenomenon known as the "breaking of the meres."

Darwin observed a similar appearance, but reddish brown in colour, off the coast of Brazil, and a different species off Cape Leeuwin, W. Australia.[1] An organism of this family gave its name to the Red Sea. Captain Cook's sailors called this scum "sea saw-dust."

INDIA.

Matherán, Western Ghâts, 2250 ft. above sea-level.

March 23rd—April 1st, 1908.

Matherán, a spur, or rather an outlier of the Sahyadri Range, lying 28 miles due east of Bombay, is unlike any place that I have visited. Approximately flat upon the top, the ground falls sheer on three sides to the dusty plain below. The steep sides are surmounted by cliffs

[1] "Journal of Researches, etc.," pp. 14–18.

of basaltic rock hundreds of feet in height, so that butterflies must be pursued with circumspection, for in many places a false step would be fatal. The ascent is made on what may be called the landward side by a toy-railway. This is a novel structure, and we stopped twice in what appeared to be most perilous places on the face of a cliff. The second time flames came out of the funnel, and they had to rake the fires out!

The plateau (as well as such portions of the scarps as are not too steep) is clothed with jungle of medium size, which, in the absence of palms and dominant creepers, has little of the tropical aspect, though Monkeys (and, it was alleged, Panthers) range therein. On emerging from this forest and going out on to one of the Points, it is difficult to believe that one is not on an island, and that the sea is not at one's feet, in place of being 28 miles away. On these Western Ghâts the rainfall is measured by feet instead of by inches, and at the end of the rainy season many of the roads have to be reconstructed to make them passable. Again, gardens are so liable to be washed away bodily, that the gardener's art is almost confined to pot-culture. It was difficult to realize these things, as we laboriously tramped through the deep red dust, for at the time of our visit the drought was extreme, the trees were in great part leafless, and I compared the colour of the grass to the very pale drab of the cover of my Letts' Diary, No. 36. There was water in Charlotte Lake certainly, but the other drinking places were reduced to puddles, or even patches of damp mud.

My captures in nine days' work were sufficiently numerous to give an idea of what the locality might be expected to produce under less arid conditions:—

Solitary males of *Danaida plexippus* and *D. chrysippus*, together with abundance of *Crastia core*, Cram. (one of the latter with a well-marked symmetrical injury to the hind-wings), represented their sub-family.

Satyrines were few and far between, comprising *Yphthima huebneri*—one so exceptionally "dry" as to lack ocelli on the underside of the hind-wing—and one remarkable example of *Mycalesis perseus*, approaching in character that taken on the Nilgiris in 1904 (see above, p. 101).

Atella phalantha was fairly numerous, odd specimens of *Precis almana* and *lemonias*, of very "dry" character, occurred; several *Neptis* were seen, the only one netted proving to be *eurynome*.

Blues were more notable for variety than numbers, *Neopithecops zalmora* being the commonest. The others taken were *Catochrysops*

strabo, *Nacaduba dana*, de Nicév., *N. ardates*, and *N. hermus*, Feld., *Polyommatus baeticus*, *Castalius decidia*, *Megisba malaya*, *Zezius chrysomallus*, Hübn., and a sadly tattered *Iraota timoleon*, Stoll, a glorious insect of fine gleaming blue with a black border. The great majority of the Blues were taken at water, as was also the solitary Erycinid, *Abisara echerius*.

The Common White of Matherán was unquestionably *Huphina nerissa*, though curiously enough it did not frequent the wet mud as at Haragama; a single *Nychitona xiphia* was taken, one also of *Terias libythea*, but of *T. laeta*, Boisd., I took several, although my note-book says "not common." Of *Catopsilia pomona* I took two; of the beautiful *Nepheronia hippia*, Fabr., a solitary male, which had a very slight scent like that of burnt sugar.

A male *Papilio demoleus* had a scent like fresh straw, while *P. aristolochiae* smelled distinctly fusty. *P. polymnestor* was rather common.

Three species of Skipper were met with, all of them new to me. *Sarangesa dasahara*, Moore, appeared to be not uncommon in a most perilous spot at the very edge of a high cliff, and I only secured one; this settled on the ground, with wings fully expanded, and so sitting was quite inconspicuous. Of *Sarangesa purendra*, Moore, I took two. *Celaenorrhinus ambareesa*, Moore, is a large Skipper of peculiar habits. I first saw it, on March 25th, at Porcupine Point, a prominent headland of the mountain. The hour was that of sunset, 6.50 p.m., and the Skippers were flying wildly about in some numbers. Three days later, in a similar spot, locally known as Louisa Point, at 7 p.m., I took another, this time at rest, with wings expanded, on the sweet yellowish flowers of Ghela (*Randia dumetorum*). At the last-named place, between 6 and 6.30 p.m., there were many large Dragon-flies hawking about, but I failed to catch any of them.

The one notable Moth was the large blue-grey, black-spotted Geometer, *Euschema palmyra*, with its very slow fluttering flight; it was not uncommon flying in the afternoon; several were "found drowned" in and about Charlotte Lake. The Matherán specimens differ somewhat from those taken in Ceylon. Another of the same family, *Luxiaria hypaphanes*, Hmpsn., has a strongly marked underside. A good specimen of the pretty *Antigastra catalaunalis*, Dup., was kicked up; it is a Pyrale widely distributed in the Old World. *Noorda fessalis* came to light. *Phycodes radiata*, Ochs. (*hirudinicornis*, Guen.), a large, robust, yellow-underwinged Hyponomeutid was taken near water.

The excessive drought and consequent great scarcity of water

brought insects of several orders to the little puddles that were all that was left of several of the watering places. Among these the Hymenoptera were in great force.

The steely-blue *Sceliphron bengalense*, the black, yellow-legged *S. intrudens*, and the smaller *S. coromandelicum*, Lepel., were all more or less common, the latter was also taken by my wife in the Rugby Hotel. *Eumenes flavopicta*, the small black and yellow *E. punctata*, Sauss., the large yellow *E. petiolala*, Fabr., and *E. edwardsii*, Sauss., were only met with by ones or twos. Two *Vespa cincta*, larger and darker than Ceylon specimens, were taken at Charlotte Lake. Several *Icaria ferruginea*, a fine example of *Sphex splendidum*, Fabr., with its big head, yellow wings, and metallic violet abdomen; *Pseudagenia blanda*, Guér., blue with red hind femora;[1] a *Notogonia* that may be new, since it is not to be found in the National Collection, nor in Col. Bingham's book; a *Nomia* and a *Crabro* also occurred. Then there were *Apis dorsata* and *A. indica*, and in addition to all these the distinct grey *Pompilus reflexus*, Smith, with its red abdomen, as well as the two small Fossors, *Trypoxylon intrudens*, Smith, and *pileatum*, Smith.

But Aculeates were not entirely confined to muddy puddles; the blue, white-banded *Podalirius fallax*, Smith, preferred Labiate flowers, as did *Anthidium ordinatum*, Smith, and *A. ardens*, Smith. Again the brilliant *Podalirius zonatus* was found on the white flowers of a shrub at Porcupine Point; *Crocisa histrio*, Fabr., black with bluish-white markings, was buzzing about the ground. I do not seem to have any note of the exact conditions under which I captured *Polistes sagittarius*, Sauss., and *P. marginalis*, var. *stigma*, Fabr., or the metallic blue-green Cuckoo-wasp, *Hexachrysis oculata*, Fabr., with its almost superfluous adornment of a ruby on its abdomen.

But while I was catching these Wasps I had not the slightest idea that along with them I had been taking two species of *Ceria*—a genus of Syrphid Flies bearing a strong resemblance to *Conops*. Of *Ceria eumenoides*, Saunders, I took seven specimens, it is a good mimic of more than one of the wasps with which it was associated, viz. *Icaria ferruginea*, *Eumenes edwardsii* and *Polistes marginalis*, var. *stigma*. Col. Yerbury tells me that his friend Col. C. G. Nurse noticed this striking instance of mimicry at the same place—Matherán—in 1899. [See Plate IV., Figs. 1–6.]

I also took a male and two females of a yellow and black *Ceria*, which Mr. Austen believes to be a new species. As will be seen

[1] Mr. Shelford writes that this wasp, which also occurs in Borneo, provisions its nest with Crickets.

from the figures [Plate IV., Figs. 7, 8], this Fly is a quite extraordinary mimic of the Wasp, *Eumenes flavopicta* [Plate IV., Figs. 9, 10]. It is a well-known rule in cases of Batesian mimicry that the mimic is scarcer than the model. This seems to be borne out by three closely allied black and yellow *Ceria*. From a single specimen, a male taken at Darjiling, de Meijere described *C. trinotata*; of another as yet undescribed species, the British Museum has a single specimen from Assam, while I took but three of my species,[1] so that presumably all are scarce.

It scarcely seems likely that *Tabanus albimedius*, Walk., was really attracted by water, though taken close to it, but several specimens of a species of *Ochromyia* were captured about foul mud at the head of Charlotte Lake; the long-winged Bombyliid, *Exoprosopa* sp., was taken about water, but not the allied *Argyramoeba distigma*, Wied.

In Charlotte Lake itself I took half a dozen specimens of *Hydaticus* sp., one *Cybister asiaticum*, Sharp, and one of another species of the same genus. On the top of the water there were Whirligigs in abundance, viz., *Dineutes indicus*, Aubé, and a species of *Orectochilus*. A *Heterotarsus* invited capture by walking over my store-boxes.

It was both hot and cold at Matherán: it would rise to 80°–84° or even 86° at midday, and the sun penetrated the corrugated iron roof of the hotel, which was very imperfectly protected by straw outside, yet in the morning it might fall as low as 71°. Moreover in the afternoon a high wind would sometimes rise suddenly, and one would shiver when the temperature fell to 73°. This is no laughing matter, and I got such a severe chill that I had to call in the services of the Civil Surgeon, Captain Superintendent McPherson, as well as make use of my bearer's talent as a masseur.

[1] Mr. Austen informs me that the name *Ceria* is preoccupied in another Order, but that there is an old name *Cerioides*, formerly belonging to the genus which should be reinstated. The latter name seems somewhat unfortunate.

CHAPTER VIII

EGYPT AND THE SÛDÂN

January 1st—April 18th, 1909

THE land of the Pharaohs has much to recommend it; but though historically of surpassing interest, as a hunting ground for butterflies it holds an extremely low place. So far as our positive knowledge goes it would be manifestly unfair to accuse the long lines of despots who ruled at Memphis or Thebes of having caught all the butterflies, but it would not be so unreasonable to attribute their present scarcity to the ancestors of the present fellahîn, who through all the dynasties so assiduously cultivated the valley of the Nile—for one soon learns that Egypt is the Nile, and that the Nile is Egypt.

The Great Pyramid stands at the apex of the Delta, and from that point southwards, right away to the Sûdân, there extends on either bank of the river—unbroken by any tributary—a strip of land, varying in width from a few yards to a few miles, blessed with a soil of almost unequalled fertility. Each of these strips is bounded on one side by the Nile, on the other by the barren Libyan and Arabian deserts respectively. Thus for all practical purposes Egypt may be said to approximate closely to Euclid's definition of a line—length without breadth. All the available land has been cultivated for centuries, most of it for millennia, so that the indigenous flora of the Nile valley, save such hardy fragments of it as could adapt themselves to the artificial life of "weeds of cultivation," has long since disappeared, and what it may have been like no man knows. With this flora has departed a fauna, probably never very extensive, but doubtless very interesting.

In spite of the Badâwîn, and their countless camels and goats—animals that find a sustenance where others would soon perish—the Desert has to a great extent held its own, and its flora and fauna retain much of their original character. The insect fauna of the

desert will always be associated with the name of Klug, and his monumental work.[1]

The wonderful paintings, still so marvellously preserved in many a temple and tomb, tell us that three thousand years ago, as to-day, the wheat cultivated by the Egyptians was of the bearded variety, which, as seen at a distance, makes the ripe cornfields look "white to harvest," in place of golden, as in other lands. From these same paintings it may safely be inferred that many plants and animals, now to be found only in the far Sûdân, were then familiar objects in both Lower and Upper Egypt. Even a butterfly caught the observant eye of those old-time artists, and portraits of it have been handed down. One of these entomological illustrations adorns a tomb at Beni-Hasân; this tomb bears a date showing that it belongs to the Twelfth Dynasty, earlier, that is, than 2000 B.C. Other insects are represented on the painted pavements of the Eighteenth Dynasty at Tell al-Amarna, say 1500 B.C., but perhaps the most perfect representation, from a tomb at Thebes, is now in the British Museum at Bloomsbury. This tomb is said to be that of a Scribe of the Royal Granaries of the time of Seti I., say 1400 B.C. Besides a celebrated cat and many birds, no less than seven butterflies are figured, all evidently belonging to one species.[2] Unfortunately these paintings are not sufficiently well executed, or, it may be, not sufficiently well preserved, for it to be possible to dogmatize as to the specific identity of the insect represented, but it would, I think, be safe to hazard the conjecture that it is *Danaida chrysippus* (or possibly its variety *dorippus*)—indeed it would appear to be mid-way in colouring between the type and the variety. It may be confidently asserted that the model before the painter was not *D. alcippus*, since the white hind-wings of that form must have riveted the attention of a far less careful draughtsman. The body bears conspicuous white spots, but the transverse white bar seems to be broken up into spots; the black marks on the hind-wing are clearly indicated. One of the butterflies appears to have six functional legs, but the artist might have allowed his knowledge of the general hexapod character of the Insecta to direct his brush.

A visitor to Egypt will soon notice that the wind usually blows from the north, and this is a circumstance of the weightiest economical and even political importance, since it is thereby possible

[1] "Symbolae Physicae Insectorum," Klug and Ehrenberg, 1830–1845.

[2] A good "process" reproduction of this painting will be found in "A History of Egypt," by J. H. Breasted, Fig. 156.

for sailing vessels to make their way up against the stream during some part of most days. If it had not been for this prevalent wind it is safe to say that Egypt could never have enjoyed its long prosperity, not to speak of the fact that its climate would have been insufferably hot.

The PYRAMIDS OF GÎZA, lat. 30° N.

January 1st—4th.

For me Egypt began and ended at the Great Pyramid. At its very base, surely quite indifferent alike to the ambitions of Cheops, and the speculations of the Pyramidologists, I found two worker ants, *Myrmecocystus viaticus*, Fabr., one of which ran rapidly over the sand, carrying the smaller of the two in its mandibles. On the surrounding desert another ant, *Aphaenogaster arenaria*, Fabr., was to be found under stones, or sometimes running over the sand, while *Monomorium salomonis*, Linn., occurred on and about the Umbellate, *Deverra tortuosa*, Desf., a plant also frequented by the Lady-bird, *Coccinella* 11-*punctata*, Linn.; doubtless they were both in pursuit of Aphides, but I made no note of the presence of the latter. A stone on the very edge of the desert gave shelter to three specimens of the Mutillid, *Ephutomma continua*, Fabr.

Turning stones also produced the Weevil, *Dicranotropis* (*Cleonus*) *hieroglyphicus*, Oliv.; the Heteromera, *Ocnera hispida*, Forsk., and *Mesostena laevicollis*, Sol., as well as the Dung-beetle, *Onthophagus* (?) *marmoratus*, Faldm., and immature individuals of the Earwig, *Labidura riparia*, Pall. About the roots of such plants as might be found upon the desert in mid-winter were several *Tentyria glabra*, Sol. The black, clean-looking *Pimelia angulata*, Fabr., was occasionally to be seen crawling over the sand, but was more common among rubbish in the hotel garden.

In the last-named locality the big Carpenter-bee, *Xylocopa aestuans*, Linn., a female, the yellow *Philanthus triangulum*, Fabr., with its waxy-looking abdomen, also a female; and two females of the Fossor, *Ammophila tydei*, Guill., were taken. The common Beetle, *Aulacophora foveicollis*, Küst., was to be found in any numbers upon vegetable-marrow. Among mixed herbage in the garden I took an immature *Chrotogonus lugubris*, Blanch.; this is an Acridian of the sub-family *Pyrgomorphinae*, which I met with frequently in Egypt. On the golf-links I took, under stones, an undetermined *Ocnera*.

At Tamarisk flowers on the Nile bank at Gîza, I caught in my

hand two *Stilbum splendidum*, Fabr., of the blue form, *amethystinum*, while *Myrmecocystus viaticus* was rushing about at my feet.

During my very short stay under the shadow of the Pyramid, I saw but two species of Butterflies and two of Moths. Several *Pyrameis cardui*, Linn., and a couple of very dark but otherwise typical *Danaida chrysippus*, Linn., were observed in the hotel garden. *Cirphis loreyi*, Dup., a great rarity in Britain, came to light, and the pretty Crambid *Eromene ocellea*, Haw., another British rarity, was found by Mrs. Longstaff in our sitting-room and also seen by myself on the desert.

A voyage up the Nile in one of Cook's luxurious steamers does not give the entomologist much scope, especially as, rightly enough, almost every moment on shore is devoted to the all too hurried study of the wondrous ruins which make Egypt unique among countries.

January 5th. At Sakkâra, near the tomb of Ptah-hetep, *Pimelia angulata* was found crawling on the sand.

At Badrashên (lat. 29° 48′ N.), a number of Moths visited the glow-lights of the "Rameses the Great": *Agrotis ypsilon*, Rott.[1] (*suffusa*, Fabr.); *Euxoa spinifera*, Hübn.; the Boarmiid, *Tephrina disputaria*, Guen., and abundance of *Eromene ocellea*, certainly the commonest moth of the Nile valley.

January 8th. The thermometer on deck at 8 a.m. was as low as 50° F., but it was much warmer when we reached Asyût (lat. 27° 12′ N.) where about a dozen worn and broken specimens of *Danaida chrysippus* were seen, all appeared to be typical. Several *Stilbum splendidum* glistened in the sun, and the Bee *Eucera nigrilabris*, Lepel., a female, was taken with them. In the suburbs workers of *Myrmecocystus viaticus* were seen running swiftly about in the neighbourhood of their nest.

January 9th. At 8 a.m. the thermometer on deck fell to 46° F. and it was very cold in the wind. At Sohâg (lat. 26° 35′ N.), *Agrotis ypsilon* again came to the lights of the steamer, accompanied by a few *Eromene ocellea* and our old familiar friend, *Nomophila noctuella*, Schiff.

January 10th. On the Nile bank at Dendera (lat. 25° 38′ N.) the black somewhat fetid Bug, *Aspongopus vidualis*, Fabr., was to

[1] The larva of this Noctuid—the Cotton Cut-worm—is a serious pest to the Fellahin, greatly damaging the young cotton crop.

be found in large numbers under the leaves of Vegetable-marrow. The walls of the beautiful temple of Hathor were literally plastered with nests of the Mason-bee, *Chalicodoma sicula*, Rossi; all that I captured were females. The Noctuid, *Spodoptera mauritia*, Boisd., came to light at this place.

January 11th to 14th. Luxor, lat. 25° 38′ N. Here *Vespa orientalis*, Linn., put in its first appearance: Miss Wurtz caught one on board, the only male that I came across, but specimens of the other sex were met with in the Ramesseum and in the Temple of Amen, where *Myrmecocystus viaticus* and *Monomorium subopacum*, Smith, were also to be found. *Stilbum splendidum*, var. *amethystinum* was taken at Tamarisk flowers near the Ramesseum, and upon the same plant I found two of the handsome green Buprestid, *Steraspis speciosa*, Klug. Stone turning brought to light *Mesostena laevicollis*. At Medînet Habu *Chalicodoma sicula* was common, but not in such large numbers as at Dendera. A female of *Eumenes tinctor*, Chrst., was taken in the hotel garden; I had knocked one down with my hat on the deck of the steamer the day before, when about a dozen miles north of Luxor. In the garden I took also a solitary female of *Tarucus telicanus*, Lang, a butterfly that I had previously met with both in South Africa and in India. After dark a specimen of *Caradrina (Laphygma) exigua*, Hübn., came to light, the larva of this moth (a rarity in England) does much damage to the young cotton plants and to barsîm (White clover).

January 15th. The well-known Red Locust, *Schistocerca peregrina*, Oliv., was captured in the Temple of Horus at Edfû, and on the same day the Fly, *Agria nuba*, Wied., came on to the steamer.

January 16th. At Kôm Ombo (lat. 24° 30′ N.) several *Danaida chrysippus* were seen, all typical but very dark; a male is noted to have had the day after capture (dead) a very strong musk-rat, or mousy, odour.

Aswân, lat. 24° 5′ N.

January 17th—27th.

As a butterfly locality I expected more of Aswân (situated as it is just north of the Tropic of Cancer) than subsequent experience justified, but it is of course quite likely that more things might be found later in the year. The parts of the desert that I visited appeared to be quite devoid of vegetation—often there was not even a

blade of dead grass to be seen, nothing but sand, rocks, and sky. I say "appeared," for I came across the trails of Lizards, and where there are lizards there must be insects, and where there are insects in all probability vegetation of some kind, though it is conceivable that lizards might subsist on insects dependent in their turn on the dung of passing animals. It was hard to remember that it was mid-winter.

Such insects as I did come across were mostly seen in the small oasis near the golf-links, especially on a small patch of a lilac-flowered Crucifer that I took to be Radish (*Raphanus sativus*, Linn.). Here *Pyrameis cardui* was in abundance, but faded and worn; many were seen to orient; among the Painted Ladies were a few *Danaida chrysippus*, dark but otherwise typical. The same patch of flowers attracted many insects of other orders, conspicuous amongst them being *Eumenes tinctor* and *E. dimidiatipennis*, Sauss.; there also *Elis senilis*, Fabr., was in abundance, its sexes so unlike that it did not occur to me that they were conspecific. Of all the insects on those flowers the Cetoniid, *Epicometis squalidus*, Linn., was the most abundant, and I could easily have collected a pint of them, whereas a *Stilbum splendidum* was alone in its glory.

In the same oasis that long-legged, black, spider-like Heteromeron, *Adesmia cothurnata*, Forsk. (? *bicostata*, Klug), was to be seen running about in all directions, occasionally accompanied by his big relative, *Ocnera hispida*, more often by the common ant, *Myrmecocystus viaticus*. A *Steraspis speciosa* was found on an Acacia, and a dead one on the ground. A potsherd gave shelter to the Noctuid *Sesamia* (*Nonagria*) *cretica*, Leder.; sundry stones on the desert round about concealed *Sceliodis castaneus*, Eschsch., *Mesostena laevicollis* and *Pimelia grandis*, Klug.

On the right (eastern) bank of the Nile, close to the river, *Polyommatus baeticus*, Linn., was occasionally to be seen together with a *Danaida chrysippus* and two or three *Pyrameis cardui*. Here Mustard flowers (*Sinapis* sp.) proved to be specially attractive, yielding a *Halictus*; *Andrena ephippium*, Spin.; *Megachile albocincta*, Rad.; *Eumenes tinctor* and *Elis senilis*. The same flowers attracted the handsome well-named Fly *Eristalis taeniops*, Wied., and the Beetles, *Himatismus villosus*, Haag, and *Coccinella* 11-*punctata*, Linn. Stone turning produced *Ocnera hispida*, a number of *Thriptera crinita*, Klug, and a Scorpion.

In the Garden of the Cataract Hotel on January 26th, 1909, at about 5.30 in the afternoon, Miss Stracey called my attention to a number of *Stilbum splendidum* upon a *Parkinsonia* (an Australian tree with yellow flowers); they formed two clusters, one on a branch,

the other on pods, consisting of 14 and 34 individuals respectively; they were sitting close together, quite still, and appeared to be stupid. Mr. Morice was much interested in my account of this observation, which he is not able to account for, and cannot exactly match by any other recorded case among the *Hymenoptera*. I mentioned the matter to Mr. F. C. Willcocks, F.E.S., of Cairo, but he said that he had never noticed anything of the kind, though he interests himself in insects of all orders. Mr. Morice informs me that *Stilbum* infests the larvae of the larger species of *Eumenes* (especially *dimidiatipennis*) exactly as Ichneumons do those of Lepidoptera.

On the island of Elephantine, in the hotel garden, I captured a specimen of *Tarucus telicanus* at *Duranta* flowers, where it was accompanied by the following Bees and Wasps:—a male *Podalirius* near to *albigena*, Lepel.; a male *Ceratina tarsata*, Moraw.; *Elis senilis* in abundance; a male *Odynerus* (?) *bellatulus*, Sauss., and three specimens, all males, of an *Odynerus* (*Lionotus*) of the *minutus* group, which Mr. Morice thinks may be new; a male *Philanthus coarctatus*, Spin., and *Eumenes tinctor*. There were in addition several *Stilbum splendidum*, and the Flies, *Eristalis taeniops* and *Syrphus aegyptius*, Wied. (? *scutellaris*, Fabr.). The common Egyptian Sarcophagid, *Agria nuba*, sunned itself on the leaves of *Canna*. It was in this garden also that I took a male *Gegenes nostradamus*, Fabr., the only Skipper that I saw in Egypt.

In cultivated fields, about the flowers of lupins and beans, females of the big *Xylocopa aestuans* were not uncommon; grassy places harboured *Chrotogonus lugubris*, while *Pimelia spinulosa*, Klug, ran over the sand near high-water mark or lurked under the leaves of marrow. At the south end of the island I came across a large pot-hole in the granite, perhaps four feet across by three feet in depth; it was high above the water, and partly filled with sand on which were about 100 specimens of the *Pimelia*, a few still alive, but mostly dead, and many of them bleached from black to a rich brown. On the open sand I found a single *Blaps gages*, Fabr., and two small, dead Dung-beetles, *Catharsius sesostris*, Waterh. (*pylades*, Péring.), a creature that ranges over to Sierra Leone in one direction, and down to South Africa in another.

Mrs. Longstaff found three moths in the hotel:—*Eromene ocellea*; a Nolid, which Sir George Hampson thinks is new; and a dead *Euxoa spinifera*.

On the left (western) bank there is but the narrowest strip of cultivation, a very few yards wide, squeezed in between the river

and the cliffs of rich golden sand, beyond which lies the desert. Here, as at Mena, it is sometimes literally possible to stand with one foot on cultivated land, the other on the desert. Along the line of demarcation, at the foot of the talus of blown sand, some traces of the indigenous flora persist, I noticed specially a small pink-flowered Papilionaceous plant (probably *Lotus arabicus*, Linn.), a coarse grass and a few Acacia bushes. The last bore evident traces of Lasiocampid larvae in the shape of untidy webs and defoliated branches. On and about the *Lotus* a neatly marked, but not very brilliant Blue was quite abundant; this turned out to be *Catochrysops eleusis*, Dem., a butterfly that is not common in collections; its range would appear to be limited to Upper Egypt and the Sûdân.[1] There were among the more numerous *Catochrysops*, a few *Polyommatus baeticus*, and a solitary little *Chilades trochilus*, Frey., the latter was sitting head down moving its hind-wings in the characteristic Lycaenid fashion. A few *Eromene ocellea* were disturbed from the patches of bean and lupin. There were a few of the commoner Aculeates among the flowers. At the roots of grass the Beetle *Sceliodis castaneus* was in abundance. I found my first specimen of *Scarabaeus sacer*, Linn., lying on the ground dead. This beetle takes us back to the beginnings of history, for, as is well known, it was an object of worship to the ancient Egyptians. To how many has it occurred that its very name is a connecting link between Egypt, Germany, and England? Kheper[2] is surely the same word as the German Käfer, and the English Chafer, and according to the Egyptian mythology, the Scarab God, *Kheperâ*, was the creator of the world.

Here again *Chrotogonus lugubris* was well protected by its cryptic colouring, but *Ocnera hispida* and *Thriptera crinita* sought concealment under a log of wood, whereas *Adesmia cothurnata*, as usual, ran merrily over the ground, scorning any subterfuge. The Bug, *Aspongopus vidualis*, rejoicing in a fetor peculiarly its own, might be found in plenty under the leaves of Colocynth, *Citrullus colocynthis*, Schr. (Nat. Ord. *Cucurbitaceae*), that seductive gourd which thirsty travellers have too often been tempted to taste.

A visit by boat to Aisanarti Island, just below the Cataract, yielded a male *P. baeticus*, a female *C. eleusis*, also two females of the yellow, brown, and black *Eumenes esuriens*, Linn., a *Blaps gages*, and some even commoner things.

January 28th. At Dakkeh (lat. 23° 15′ N.), just within the Tropics, a somewhat greater variety of moths than usual visited the

[1] See below, p. 569.

[2] The *kh* is a hard guttural.

ship's lights: prominent among them was *Deilephila livornica*, Esp.; then there were two of the Lasiocampid, *Trichiura obsoleta*, Klug, a moth which occurs at Cairo; an Acidaliid, *Craspedia consentanea*, Walk., and several of the now familiar Crambid, *Eromene ocellea*.

January 29th. At Amâda (lat. 22° 45′ N.) I took my first specimen of that curiously "watered," or perhaps it should be "damasked," Blue, *Azanus ubaldus*, Cram., a female; also two of the Leaf-cutter, *Megachile albocincta*. From a diminutive native I acquired a relatively large Chamaeleon and took it on board. My preliminary observations confirmed the phenomenon that the side of the creature turned towards the sun darkened, but, before my observations were complete, an officious fellow-passenger liberated the animal during my temporary absence.

The same evening near Kâsr Ibrîm (lat. 22° 35′ N.) *Eromene ocellea*, which I had found in plenty among the coarse grass at the landing-place, came in great numbers to light, but many more interesting things came also: *Trichiura obsoleta*; six *Euxoa spinifera*; a female of the more familiar *E. segetis*, Schiff.; *Agrotis ypsilon*; *Chloridea* (*Heliothis*) *peltigera*; *Plusia ni*, Hübn., was new to me; the little Noctuid, *Eublemma brachygonia*, Hmpsn., four specimens, also new to me, and the Phycid, *Ancylodes pallens*, Rag. The National Collection contains but three of the *Eublemma* from widely separated localities, and of the *Ancylodes* only Persian and Arabian examples. Lastly there was a Catocaline, *Hypoglaucitis* sp., which Sir George Hampson says is probably new to science [see Plate V., Fig. 5].

January 30th. At Abû Simbel (lat. 22° 18′ N.) I was surprised to see no *Danaida*, though there was abundance of the Asclepiad plant, *Calotropis procera*, Willd., neither did I come across a Painted Lady; however, both *Polyommatus baeticus* and *Catochrysops eleusis* were to be had, as well as both sexes of the common *Xylocopa aestuans*. The only Beetles taken at Abû Simbel were *Pimelia spinulosa*, *Thriptera crinita*, and *Himatismus villosus*; the Bug *Lygaeus miliaris*, Fabr., was common about the *Calotropis*. The lights brought nothing save *Euxoa spinifera* and *Eromene ocellea*.

Although the magnificent colossal statues of Rameses II., hewn out of the cliff, have to be freed at comparatively short intervals from the sand which comes down from above and accumulates about their feet, I was told by a gentleman who had climbed the cliffs that to his surprise he found no sand on the table-land above. This quite tallies with my own observations; in such deserts as I have seen rock predominates over sand. A comparatively small

quantity of sand, blown about by the winds, finds a resting place here and there, at the foot of a cliff or against the walls of a building.

January 31st. Wâdî Halfa (lat. 21° 55′ N.) is really the first town in the Sûdân, but from a naturalist's point of view might be better looked upon as the last town in Egypt. In the short time at my disposal I got next to nothing. *Andrena bipartita*, Brullé, was abundant in the cultivated land to the north of the town, and in the same district I caught a couple of *Colletes braccatus*, Perez, and one *Megachile albocincta*, for although Leaf-cutters were common enough they are sometimes exceedingly hard to catch, and here I was successful once only.

THE ANGLO-EGYPTIAN SÛDÂN.

February 1st—22nd, 1909.

On looking out of the train in the morning after the stifling night on the Nubian desert—somewhere between Berber and the River Atbara—a change in the appearance of the country is observed. A thin thorn-scrub, varied by occasional groups of Dûm Palms, *Hyphaene thebaica*, Del., throws a slight veil over the nakedness of the desert. Occasionally a few Gazelles create a flutter of excitement among the passengers, and when the sun gets up the mirage slowly develops, as if the horizon were first softened and then evaporated by the heat. From time to time stray butterflies are seen; these I took to be *Catopsilia florella*, Fabr., though it is just possible that among them may have been *Teracolus protomedia*, Klug. During a short halt at Wâd Ben Naga Station (lat. 16° 32′ N.) I tried to solve this problem, but the sense of anxious hurry lest the train should start, the swift flight of the butterflies, the strong wind, the blinding glare, and the great heat combined to frustrate my efforts; and I only succeeded in netting a male of *Tarucus theophrastus*, Fabr., a Blue that I met with from Luxor to my southernmost point at Gebel Ein—a range of nearly 16° of latitude.

Khartûm (lat. 15° 35 N.; 1200 ft. above sea-level).

Khartûm is unlike any place that I have seen. Situated on the southern bank of the Blue Nile, just above its junction with the White Nile, it is a new city; it is, moreover, a European city, for the native population lives almost exclusively in mud villages on the outskirts. The palace in which Gordon lived and died is its oldest

edifice, though built by Ismail Pasha; on either side of this, stretched along the river bank, is a long line of Government Offices and barracks interspersed with the comfortable houses of officials set each in its pleasant garden. Since every one, naturally enough, wished to have a bit of river frontage the length of the town is considerable, but its breadth insignificant, and its cross-streets starting from the river run vaguely into the desert.

At the end of one of these cross-streets, hard by the rising walls of the Anglican Cathedral, stands Hamo Thorneycroft's fine statue of Gordon, who, sitting his camel with the grace for which he was famous, seems to gaze wistfully over the boundless desert. In Khartûm one feels always in the hushed presence of Gordon, just as in Omdurmân one is haunted by the evil genius of the Khalîfa. The familiar figure of Sir Rudolph von Slatin Pâshâ, seen daily in the streets, reminds one how very recent are the terrible events of January, 1885, when every man, every child, and every *old* woman was ruthlessly put to the sword. In a place whose tragic history is but of yesterday, a place 1000 miles from Cairo, it seemed wonderful to find people living not only in peace and security but even in luxury. Perhaps the incongruity seemed greatest when listening to the string-band of the Sudanese regiment playing dance-music after dinner.

The following story reached my ears, of which it may be said, *se non é vero é ben trovato:* A man who knew Khartûm well, and the officials resident there, found himself one day at Omdurmân while Cook's dragoman was holding forth as to the objects of interest. Standing on the top of the Khalîfa's house he pointed to a neighbouring building and said: "That is where von Slatin Pâshâ lived with his eleven wives." He at once rebuked the dragoman, saying that of course his statement was—at least as to the wives—entirely without foundation; moreover that Slatin was a great man and powerful, and that if he heard of it the dragoman's stay in Khartûm would be short. A week later a friend came to Khartûm, and the first man said to him: "Have you been Cook's excursion to Omdurmân?" On receiving an affirmative reply he said: "By the way, what did the dragoman show you? Did he mention von Slatin?" "Oh yes," was the answer. "As we stood on the top of the Khalîfa's house he pointed to a neighbouring building and said: 'That is where von Slatin Pâshâ did *not* live with his eleven wives.'"

The day after my arrival I was walking over the desert to the eastward, beyond the rifle ranges. To my left and left front lay the Blue Nile, its course being marked by a row of acacia trees, distant perhaps two miles. The desert was so flat and monotonous that one

seemed to make no progress, and a tree more prominent than the rest seemed as far off as ever. As I gazed at the distant trees somewhat wistfully they seemed to rise slowly into the air, and the river itself came into view. Slowly and imperceptibly the water spread itself out over the sand, until I seemed to be walking towards a lake whose surface was strangely unruffled, in spite of the strong north wind sweeping over the desert. I glanced to the left and was confronted by the same appearance of a vast inundation. Turning round I found that the same sheet of water had cut me off from the domes and palms of Khartûm. The rising river seemed both to bar my advance and to have cut off my retreat—there appeared to be water on three sides of me! Had I not seen many a mirage before, I feel sure that I should have turned and fled in terror towards the desert, and even as it was, I found it difficult to overcome a certain nervousness as I pursued my way. However, gradually as the acacia trees drew nearer and nearer, the inundation began to retreat, so that when I at last stood upon the bank, there was the Blue Nile flowing steadily many feet below the level of the arid desert.

Any description of Khartûm would be inadequate if it did not allude to the prevailing northerly wind, which is not only health-giving, but entomologically speaking most important. Mr. A. L. Butler, the Curator of the Zoological Gardens, informed me that there is no continuous rainy season, but that heavy tropical downfalls are frequent in June, July, and August.

Khartûm is not altogether a pleasant place for the collector. To the south is a specially barren[1] and wind-swept desert; the northern bank of the river is abandoned to barracks, railway works and dockyard—for Khartûm is a naval port with a fleet of gunboats—hence my operations were practically confined to the neighbourhood of the river bank above and below the city. Of the two localities, the best, though the most distant, was beyond the water-works, near the terminus of the tramway in the village of Burri. Here, among *Calotropis procera*, the wide-ranging *Danaida chrysippus* was common, and I was delighted to see alive for the first time the form *alcippus*, Cram. The white hind-wings of these beautiful butterflies are conspicuous in flight, and at once reminded me of the yet more beautiful *Acraea alboradiata*, Auriv., which I had seen in such numbers at the Victoria Falls four years before. From Cairo ot Aswân I had come across a fair number of *chrysippus*, but all of the typical form. At Abû Simbel, in Nubia, I was surprised not to meet

[1] Actually barren: potentially it is said to be fertile, a thin coating of sand covering a deep deposit of silt.

with it, since the *Calotropis* was in plenty; it would be interesting to know what form occurs there. The twenty-eight specimens brought home from Khartûm may be classified as follows:—

Typical *chrysippus*, 3 ♂.

chrysippus, but with the veins of the hind-wing dusted with white, 6 ♂, 2 ♀.

f. *alcippoides*, Moore, 4 ♂, 2 ♀.

f. *alcippus*, Cram., 5 ♂, 2 ♀.

f. *dorippus*, Klug, var. *albinus*, Lanzknecht, 1 ♂ (*i.e.* fore-wings lacking the transverse white bar, hind wings white).

Of the total specimens seen, I estimated at the time that at least three-fourths were either *alcippus* or *alcippoides*.

The musk-rat odour was evident enough in many examples, about equally strong in both sexes, but in one ♂ the scent was compared to that of tobacco.

The next most conspicuous butterfly was *Papilio demodocus*, Esp., I believe the only one of the sub-family that occurs there. During my stay it was not at all common, and I took but two (one very large and fine) and saw one or two others.

The *Pierinae* were unquestionably the dominant group. The first of them to attract attention was *Catopsilia florella*, of which I took 5 ♂ and 10 ♀; it was quite abundant along the river bank above Burri. One female was so unusually pale in colour as to resemble a male. Of the five males taken all had a sweet or luscious scent, in some faint, in others decided.

Belenois mesentina, Cram., was also abundant, especially on cultivated ground; 10 ♂ and 19 ♀ were taken; some of the specimens of both sexes were very small. One ♀ resembled a ♂ in appearance. In some of the males I detected a slight scent, once described in my note as luscious, in others as musky; in two female specimens a slight musky scent seems to have been suspected. A male had lost a large piece out of each of its four wings.

In the bean fields near the junction of the Blue and White Niles *Colias marnoana*, Rogenh. (a miniature edition of our *C. hyale*), was common. Fifteen in all were taken, including two white females. Two examples had symmetrical injuries affecting all four wings. A slight scent was noted in some specimens, described as peculiar, chocolate-like, or clove-like. The observations were, however, not very definite, and the scent was noted in one female specimen.

The prevalence of the genus *Teracolus* at Khartûm was in itself sufficient indication that we were within the limits of the Ethiopian fauna. None of the species were really common during my stay, but

of *T. ephyia*, Klug, I secured four males (two of them veritable dwarfs) and a female, missing several others—for an orange-tipped *Teracolus* flying swiftly over the sand in the glaring sunlight is more difficult to follow with the eye than might be supposed. I also took a single dwarf male of *T. daira*, Klug. To the west of the town I took the only *T. chrysonome*, Klug, ♀, that fell in my way. Lastly, I caught near the tennis-ground a female of *T. protomedia*, which seemed to me to have a faint scent like opium. At Burri I secured a specimen of the very beautiful *Calopieris eulimine*, Klug.

I did not come across a single Satyrid or Skipper in the Sûdân. There was but one Nymphaline—the ubiquitous *Pyrameis cardui*, which was met with in the largest numbers on an exposed piece of ground at the very point of junction of the two rivers, exactly where one would have expected to see it. A fresh brood made its appearance on February 7th; one of these, a male, had an unusual underside, very grey in tone, with but little dark shading, and without any black in the ocelli. Even slight variations are rare in this remarkably constant species.

Blues were fairly numerous though of few species; *Polyommatus baeticus* and *Tarucus theophrastus* were both abundant, the first especially in bean fields, the second about Acacia bushes, or at flowers of *Aerva* (?) *javanica*, Juss., a plant belonging to the Natural Order *Amarantaceae*. I fancied that a male of the former butterfly had a slight scent like Meadow-sweet, while one of the latter had a moderately strong, sweet, luscious odour. Of *Azanus ubaldus*, I took half a dozen, having previously come across a female at Amâda in Nubia. Of the little *Chilades trochilus* (a species also met with at Aswân), I took only one. *Zizera lysimon*, Hübn., was commonest on weeds in fields from which a crop had been removed, especially frequenting *Aerva* and a species of *Arnebia* (Nat. Ord. *Boragineae*). On the other hand, *Catochrysops eleusis* was common about small, low-growing, white-prickled Acacia bushes on the edge of the desert. The Khartûm males were markedly bluer, less violet, than the Aswân specimens.

Moths were not very numerous, but many of those taken were interesting. The almost cosmopolitan *Utetheisa pulchella*, Linn., was fairly common on both sides of the town. The little Pyrale, *Noctuelia floralis*, Hübn., which is like an "improved" *Herbula cespitalis*, Schiff., occurred at the flowers of *Arnebia*, and the handsome *Deilephila livornica* was taken at about 11 a.m. one hot, sunny morning, hovering at the flowers of *Echium* sp., both Hawk-moth and flower being

quite Palaearctic. All my other moths were victims of the seductive attractions of the electric lights. On some evenings, when the north wind was not too strong, these were much frequented, but while boxing moths on such occasions crowds of small flies entangled themselves in my scanty hair in a most irritating way. Amongst the moths *D. livornica* turned up again, with it was a singular pale grey Syntomid, *Apisa canescens*, Walk.; also several Geometrids, including *Craspedia consentanea*, which I had taken at Dakkeh, and even as far north as Luxor; a very worn *Tephrina*, probably *disputaria*, var.; four specimens of *Peridela sudanata*, Warr. & Rothsch.;[1] also an "Emerald," new to science, which Mr. L. B. Prout has described for the next part of his contribution to Wytsmann's *Genera Insectorum*, under the name *Prasinocyma sanguinicosta, sp. nov.*; as so often happens with novelties, a unique example. There was in addition a male specimen of a Lymantriid which Sir George Hampson has described[2] as *Porthesia erythrosticta, sp. nov.* [Plate V., Fig. 7]. He says it resembles *Euproctis rufopunctata*, Walk. The *Noctuae* were more remarkable than numerous; several specimens of *Caradrina exigua*, whose larva feeding on cotton, barsîm (a kind of clover), and *Hibiscus*, is quite a plague to the farmers of modern Egypt; a female of *Euxoa spinifera*, another common Egyptian moth; four specimens of *Sesamia cretica*; one of *S. apunctifera*, Hmpsn., the latter very distinctly marked, more so than any in the National Collection. Another cotton pest of Egypt, *Prodenia litura*, Fabr. (*littoralis*, Boisd.), was represented by a single example. One of the most unexpected visitors was *Copicucullia sublutea*, Graes. [Plate V., Fig. 9]; the type of this species came from Eastern Turkestan, and the British Museum possesses but a single example, and that from the desert of Gobi in Northern China, no less than 30° N. and 70° E. of Khartûm! Sir George Hampson thinks that desert insects probably have an unusually wide range, since desert conditions are similar over very large areas (a remark that applies with almost equal truth to areas long under cultivation). Of *Spodoptera mauritia*, two specimens turned up; of the common and very active Quadrifid, *Acantholipes affinis*, Butl., only one. Of a Catocaline, which is probably a new species of *Hypoglaucitis*, I took two, and Mrs. Longstaff another; a specimen of the same moth came to the lights of the steamer at Kasr Ibrîm, in Nubia, on January 29th.[3] As might have been expected, there were plenty of Pyrales among the frequenters of the lamps: two Galleriids,

[1] *Novitates Zoologicae*, vol. xii., 1905, p. 28, Fig. 26.
[2] *Ann. Mag. Nat. Hist.*, Ser. 8, vol. v., 1910, p. 436.
[3] See above, p. 402, also Plate V., Fig. 5.

one the unattractive *Lamoria imbella*, Walk., four specimens, this is a widely distributed African species, ranging from Natal to the Nyanza; the other *Arenipses sabella*, Hmpsn., a species found in Arabia and on the Persian Gulf, of which I also got four. Other Pyrales were the almost cosmopolitan *Hellula hydralis*, Guen., one; *Noctuelia floralis*, two; *Polyocha anerastiodes*, Warr. & Rothsch., one; the ubiquitous *Nomophila noctuella*, three; *Noorda blitealis*, Walk., a species that ranges from Ceylon over India to Aden was in abundance; *Eromene ocellea*, two, small and pale when compared with the large numbers seen in Egypt; and *Etiella sp. nov.*, still in Sir George Hampson's hands. Also a Tortrix which Lord Walsingham says is the cosmopolitan *Bactra lanceolana*, Hübn.

For the determinations of the Hymenoptera brought home I am greatly indebted to my old friend the Rev. F. D. Morice (now President of the Entomological Society of London), who spent much time over them.

Ants did not make themselves very obvious. On the battlefield of Kerreri, during an extremely hurried visit, I managed to secure a worker of *Camponotus sericeus*, Fabr. In the hotel at Khartûm my first capture was a worker of *C. sylvaticus*, Oliv., var. *maculatus*, Fabr. In the Zoological Gardens close by I took on the trunk of a *Parkinsonia* three worker ants of which Mr. Morice writes: "This *Camponotus* is unknown to me, unless it be a form of *pubescens*, Fabr.; the pilosity is very curious." I did not meet with either of these three ants in Egypt. In the western suburbs, toward Mogran, I found a worker of *Myrmecocystus viaticus* running rapidly over the ground; in the same neighbourhood, under a stone, I found an ant which, with the general appearance of a Formicid, has a long and powerful sting; Professor C. Emery has been good enough to name it for me as *Euponera (Brachyponera) sennaarensis*, Mayr, a well-known Ethiopian form, but unlike the other ants named not extending into the Palaearctic Region.

Another ant, *Prenolepis longicornis*, Latr., hunted on the luncheon table; while *Aphaenogaster barbara*, Linn., was common in the garden; a male of the red and black Mutillid, *Apterogyna savignyi*, Klug, was also taken in the hotel.

Of the difficult genus *Myzine* I met with three species on the Mogran hunting ground. The commonest appears to be *fasciculata*, which the late Mr. Ed. Saunders described from Biskra; of this I took seven specimens, all males; of *rousselii*, Guér. (also a Biskra insect), I took four males; lastly, there were two males which Mr. Morice thinks may be either *aegyptiaca*, Guér., or *guerini*, Lucas

(*latifasciata*, Palm.); perhaps it is the insect represented in Fig. 27 of Savigny's Plate xv.

On the river bank to the east of the town, beyond the water-works, I took a male of *Scolia erythrocephala*, Fabr., a handsome insect, black with yellow-ringed abdomen, and purple-tipped wings, with base and costa ferruginous. On the other side of the town I took a female *Scolia* very similar, though lacking ferruginous on the wings, which Mr. Morice thinks may be a variety of the last, but possibly a new species. In the same locality as the last I got a small female *Scolia*, a greyish insect with a yellow abdomen, which Mr. Morice says is quite unlike any species known to him. Of *Elis senilis* I brought home five males, varying greatly in size, some were taken on *Tecoma stans*, a yellow-flowered tree of the Natural Order *Bignoniaceae*, others on *Calotropis* near the rifle ranges.

The *Sphegidae* were numerously represented. The only *Ammophila* that I met with at Khartûm was a solitary female of *gracillima*, Tasch. Of the handsome black, yellow-legged, long-waisted *Sceliphron spirifex*, Linn., I took one at Khartûm, and Mrs. Longstaff another in the train at Mut Mîr Station on the Sûdân Railway; it also occurred at Luxor; my specimens are all females. *Philanthus coarctatus* and *variegatus*, Spin., were both abundant towards Mogran, males greatly predominating. Other abundant small Sphegids were *Cerceris albicincta*, Klug, 28 ♂, 2 ♀, and *C. subimpressa*, Schlett., 24 ♂, 2 ♀; *C. annexa*, Kohl, was not so common, only 4 ♂ and 1 ♀ being taken. The great majority of these small Sphegids (as well as of Chrysids and Flies) was obtained by sweeping the white fluffy Amarantaceous *Aerva*, but a few were obtained from the Boragineous *Arnebia*. The large Bees and Wasps, on the other hand, frequented *Tecoma stans*, *Acacia*, and *Parkinsonia*, though a few occurred at *Calotropis*.

Of *Bembex lusca*, Spin., I secured one of each sex, of *B. mediterranea*, Handl., three males, one was taken on *Aerva*, one near Burri, where, so far as I know, that plant did not grow. Of the fine large *Sphex umbrosus*, Chrst., a black-bodied insect with clear wings (save at the base), a male specimen was taken to the west of the town. In the same locality, on a small umbellate weed, I took a male *Tachytes*, a striking insect with a testaceous abdomen and dark borders to the wings. Mr. Morice thinks this may be the male of *superbiens*, Morice, the description of which will shortly appear in the Transactions of the Entomological Society; he compares it with *monetaria*, Smith, from India. A male *Oxybelus* taken at *Tecoma* flowers bears the label: "A very fine species unknown to me.—F.D.M."; of

O. lamellatus, Oliv., one of each sex was brought home; a female *Diodontus minutus*, Fabr., quite justifies its name.

The difficult genus *Pompilus* was represented by ten males of a species of the *Aporus* group.

No Social Wasps were met with; on the other hand, the solitary *Eumenes* was much to the fore, by far the commonest species being the Egyptian blue-black *E. tinctor*, of which I took ten males and four females; of *E. dimidiatipennis* and *E. lepelletieri*, Sauss., I took one male each; of *E. esuriens*, a truly hungry-looking, long-waisted beast, I took one of each sex. Of the large black, purple-winged *Rhynchium* (?) *synagrioides*, Sauss., with its orange-tipped tail, I took two of each sex; it frequented the flowers of *Tecoma*; of *R. cyanopterum*, Sauss., I found a solitary male at *Acacia* flowers; of *R. niloticum*, Sauss., I took two males at Khartûm, another at Atbara junction 200 miles to the northward. A female *Odynerus* (*Lionotus*) belonging to the *parvulus* group may possibly prove to be a new species.

The handsome and conspicuous Carpenter-bees were as common in the Sûdân as in Egypt, but in addition to the strikingly dimorphic *Xylocopa aestuans*, with its very different males and females, five males of *X. taschenbergi*, Vachal, turned up at Khartûm.

Of the Leaf-cutters several species were met with. Two *Megachile flavipes*, Spin., were taken in the western suburbs, also at *Calotropis*, near the rifle ranges; this is a small species which I afterwards found quite common in Egypt; but *M. albocincta*, also an Egyptian species, was the commoner at Khartûm, frequenting the flowers of *Calotropis* and *Tecoma*, it is not, however, by any means easy to catch, still I secured three males and five females; of *M. argentata*, Fabr., I took two males and a female, it also frequented *Tecoma*; lastly at *Calotropis* and other flowers I took three specimens of *M.* (?) *patellimana*, Spin. (or possibly a new species).

There were but two species of *Anthidium* among my captures, viz. *tessellatum*, Klug, of which I took two females; and (?) *karschi*, Friese, of which I took a male, at least a bee which Mr. Morice says is probably the undescribed male of that species. I also got several specimens of both sexes of a *Podalirius* which Mr. Morice says is near *bimaculatus*, Panz., possibly *byssinus*, Klug, but that there perhaps may be more than one species among them. Three males of *Ceratina tarsata* turned up at Khartûm.

Among the most notable of the Bees was the large, handsome, black and white *Crocisa nubica*, Lepel. It was most often seen at the flowers of *Tecoma* or *Acacia*, especially near the tennis courts, but it was extremely hard to catch; in all I secured five males and two

females. At the same flowers, both near the tennis ground and in the public garden, there was a number of a much smaller *Crocisa*, of which I took six males and a female, this is very probably undescribed. Then there were quite a number of little Bees, including *Colletes nanus*, Friese, a Biskra insect of which two of each sex were taken, some of them at *Aerva* near Burri, others towards Mogran; a single male of *Coelioxys decipiens*, Spin., was captured; it also occurs at Biskra. I also sent home four males and two females of an *Osmia*, allied to *lativentris*, Friese, but apparently distinct. Of *Nomia* I took but a solitary male *edentata*, Moraw., but found *Nomioides* more plentiful, securing besides four females of the tiny black, yellow-banded *N. rotundiceps*, Handl., a male of *N. excellens*, Saunders (originally described from Biskra specimens); this was taken at flowers of *Calotropis* on the desert near the rifle ranges; there occurred also a solitary female of what is either *N. turanica*, Moraw., or an undescribed form.

Among those gem-like creatures, the *Chrysididae*, I was successful in getting some interesting insects, although I did not find them numerous. The brilliant but widely distributed *Stilbum splendidum* was the commonest, and I brought home twelve, some of them of the var. *amethystinum*. Unfortunately, however, *Chrysis nasuta*, Mocsary, is so similar to *Stilbum* in size and general appearance that I doubtless confused the two, and brought home but two males and two females. I call this unfortunate, since it appears that Mocsary in 1902 described the male only, from Salisbury, Rhodesia; he has seen my specimens and believes them to be the two sexes of *nasuta*. *Chrysis pallidicornis*, Spin., was the commonest of the genus, and I secured seven specimens. It is variable in the colour of its tail, which may be red, reddish, or green (var. *chloris*, Mocs.). Of *C. fasciolata*, Klug, I took two; of the rainbow-coloured *C. aurifascia*, Brullé, one; the last-named is, I am informed, a rarity, but it extends as far as the Cape. Of the common Egyptian *Hedychridium aheneum*, Dahlb., I took but one. The genus *Parnopes* was represented by a male and two females of a green and red species which both Mr. Morice and M. du Buysson are agreed is new; it has been described as *Parnopes nilotica*, Morice *in MS.*, *sp. nov.* Nearly all these Chrysids, but not the *Stilbum*, were obtained by sweeping *Aerva*. The occurrence of intensely brilliant, blue-green metallic colouring in such widely separated genera as *Chrysis*, *Ampulex*, and *Euglossa* is a remarkable fact which appears to be quite unexplained.

Insects of other Orders were few in number, thus but a single species of Bug was met with, *Lygaeus militaris*, Fabr., taken among

Calotropis: it appears a very bright red on the wing. Mr. Distant tells me that it is a common species.

A servant at the hotel brought me a large Mantid in spirit, *Hierodula bioculata*, Burm., she said that it had come to light at the beginning of February. Of the common North African Locust, *Acridium aegyptiacum*, Linn., I took one. A specimen of the Locustid *Phaneroptera minima*. Brunn., came to light. Numbers of large Earwigs, *Labidura riparia*, were found under a stone near the junction of the two rivers at Mogran; I had met with the same species near the Great Pyramid.

It is to be feared that but little attention was paid to Flies, and those that I brought home were not remarkable. Of *Agria nuba*, a pair were captured. Among *Calotropis*, on the desert near the rifle ranges, I took two males and a female of *Dacus longistylus*, Wied., a wasp-like fly which Becker, in his work on Egyptian Diptera, attaches to the same plant. The brilliantly coloured Blue-bottle, *Pycnosoma marginale*, Weid., was also common on *Calotropis*, but I suspected that a dead camel close by was even more attractive to it. A solitary *Anthrax* has not yet been provided with a name. Two specimens of *Rhinia* (*Idia*) *aenea*, Walk., complete a somewhat commonplace list.

Quite the most obvious Khartûm Beetle was the dark brown and gold Cetoniid, *Pachnoda savignyi*, Gory & P., which was very commonly to be seen flying around, or settled upon the flowers of *Acacia* or *Tecoma*. When settled on a flower it was easily alarmed, and readily took to its wings. Many specimens in the British Museum have the brown replaced by yellow, but I saw none so coloured. At Burri I took flying about *Acacia* flowers two of the large green *Sternaspis speciosa*, a species common in Upper Egypt, also at the same flowers a very finely coloured example of the magnificent *Julodis fimbriata*, Klug—blue, green, yellow, and orange-red. [Plate V., Fig. 8.] The electric lights of the hotel attracted the small Chafers, *Adoretus clypeatus*, Burm., and *Schizonycha* sp., as well as two specimens of the small Dung-beetle, *Catharsius sesostris*. Amongst the odds and ends attracted by the light was an *Opatrum*, as usual obscure and nameless. Of *Himatismus villosus* I found one on the Cathedral site, while three others came to light. Débris under bushes of *Calotropis* gave shelter to a *Sceliodes castaneus*, and a number of the abundant *Ocnera hispida*; of the latter Mrs. Duckett took one in the hotel. *Zophosis plana*, Fabr., crawled upon the sand near the rifle ranges. Other beetles met with were *Coccinella* 11-*punctata*, and five specimens of *Bulaea lichatschovii*, Hummel, var. *pallida*, Muls.

Unfortunately, when we reached Khartûm the dry season was so

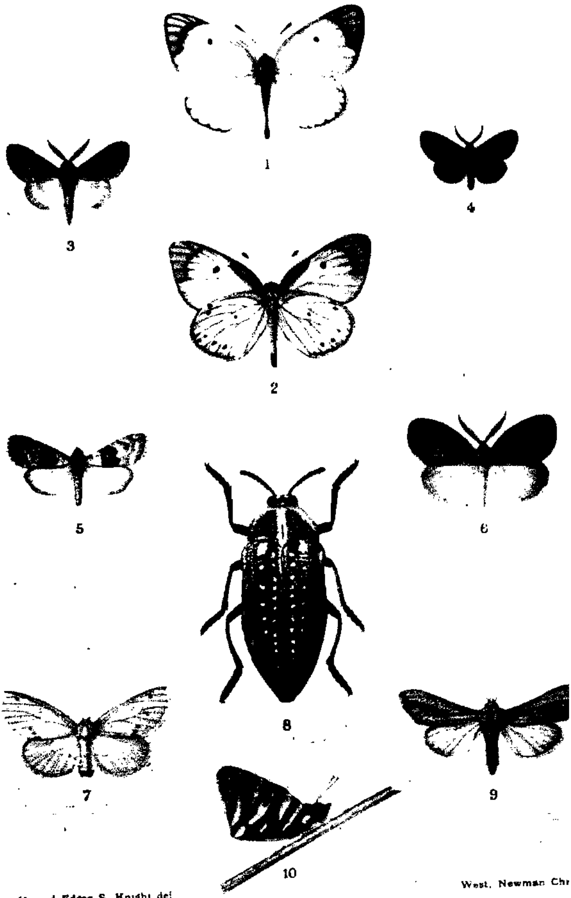
far advanced that with the water at such a low level it was not possible to make the usual excursion up the Blue Nile. However, after a good deal of difficulty I managed on February 15th to hire a small oil-fed steam-launch, in which we got to Sôba, fifteen miles up stream, where mounds and brick-bats are all that remain of the evidently once considerable capital of the Christian kingdom of Aloa. We landed on the north side of the river at about noon, and had to climb up a steep bank sheltered from the north wind, with the sun's rays pouring down upon our backs with a power that I have seldom experienced, so that I fully expected to be struck down. At the top we found ourselves in a somewhat scanty thorn-scrub.

The Sûdânese keeper of the ruined shanty, by courtesy called the Rest-house, with the aid of two female slaves, prepared some coffee for me. A few beans were roasted in the ashes of a wood fire, they were then ground with a stone in a rough mortar. The operation of boiling was effected in a narrow-necked pot of the local red earthenware, and the liquid was strained through a tuft of grass thrust into the mouth of the pot. After boiling up three times and straining as often, the red pot was served up in its own elegant cosy of plaited straw of many colours. The resultant fluid was *café noir* of the finest flavour that it has ever been my lot to taste, a result probably attributable to the fact that less than half an hour had elapsed since the roasting of the beans.

The cruel prickles, the great heat, and the strong wind, contributed to make collecting difficult. With the exception of a female of the common *Eumenes tinctor,* found in the Rest-house, and two Sphegids, *Bembex mediterranea* and *Tachysphex fluctuatus,* Gerst., both females, all my captures were butterflies. Of the orange-tipped *Teracolus ephyia,* I took four males, in one of which I detected a sweet scent; a male *Belenois mesentina* also had a sweet scent, which was lacking in two females. *Tarucus theophrastus* was in abundance about bushes; one at rest was seen to move its wings after the manner common among Lycaenids. The take of the day was a nice little series of seven males of *Calopieris eulimine,* four of them in fine condition. This is not only a scarce, but a most beautiful insect; the orange tips to its fore-wings are delicately shot with violet, while the veins on the underside of the hind-wings are brilliant orange. [Plate V., Figs. 1, 2.]

Plate V.

NORTH AFRICA.



H. and Edgar S. Knight del

West, Newman Chr

1. CALOPIERIS EULIMENE.
2. do. do. UNDER SIDE.
3. TRICHIURA DEFINITA.
4. EUPROCTIS XANTHOSOMA
5. HYPOGLAUCITIS, sp. nov.
6. LAELIA SEMINUDA.
7. PORTHESIA ERYTHROSTICTA.
8. JULODES FIMBRIATA.
9. COPICUCULLIA SUBLUTEA.
10. EUCHLOË BELEMIA.

The White Nile.

February 16th—20th, 1909.

Unfortunately a projected journey as far as the Bahr-el-Ghazâl fell through, and I was able to carry out but a very short expedition, which, nevertheless, was the most interesting part of the whole tour.

The steamer was very comfortable and the manager civility itself: indeed so luxurious is travelling nowadays that we were somewhat disposed to grumble when the supply of ice failed. Yet one might well plead extenuating circumstances, for aërated water without ice is apt to taste flat at 114° F. in the shade. It was, however, really tantalizing to be five days in a country of such possibilities, and yet to get in all less than twelve hours' collecting. An entomologist ought, if possible, not to be pressed for time, and he ought to travel in a private steamer.

On February 16th, when about 40 miles above Khartûm, at 4.50 p.m., there being a gentle breeze from the *westward*, numerous Lady-birds coming from the *eastward* settled upon the ship. All those examined proved to be *Coccinella* 11-*punctata*, a common Egyptian species. The flight lasted a little over an hour, and there must have been hundreds of the beetles.[1]

During the greater part of the way the steamer passed through absolutely flat country elevated but little above the river. At this stage interest centred on the number and variety of large birds. We soon came to Cranes—grey, demoiselle, and others—Storks, Ibis, Herons, Geese of several sorts; Ducks and Teal innumerable. On low muddy islands the Cranes stood in rows like soldiers, each kind by itself, in scores or even hundreds. Of Pelicans we saw but few, of Flamingoes possibly one or two. Then there was the Marabout, which is a very handsome bird; so is the less common Fish Eagle. There were also Kingfishers and other small fowl.

Crocodiles were frequently seen asleep upon the banks, for the most part very cryptic, but one or two were more brightly coloured. One big fellow quite deceived the experts who declared it to be a log, a diagnosis that was upset by a rifle shot. My wife complained that her usual afternoon siesta was much disturbed owing to the fact that "the gentlemen *would* shoot crocodiles." A more correct phrase would have been "shoot at crocodiles," for the huge creatures were hard to hit and harder still to kill. Hit or missed they invariably

[1] *Proc. Ent. Soc. Lond.*, 1909, p. xxxii.

got away so that none were measured, but I should guess that several must have been from 6 to 8 feet in length.

We soon reached Papyrus, at first a plant or two, but later plenty. With the Papyrus appeared the Hippopotamus; of these ungainly monsters we saw perhaps eight, or at least the tops of their heads and backs.

The Shillûks are among the savage races that rise superior to clothing. On state occasions they wear feathers in their hair, and sometimes, I believe, a string of beads round the waist, but two gentlemen that we saw fishing from a canoe had left all such vanities at home, doubtless to avoid the chance of damage by immersion. It is a strange fact that the wooden pillow used to-day by the Shillûks is practically identical with those upon which the heads of mummies rest. [See Fig. 14.] Altogether it was a most delightful trip, though all too short.

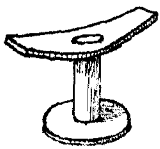


FIG. 14.—Shillûk Wooden Pillow.

At one stopping place we were brought what we were told was Lotus—it was, however, not the sacred *Nelumbium*, but a white water-lily somewhat larger than our English *Nymphaea alba*, Linn.

Later we entered a very scanty forest which appeared to consist chiefly of Acacias and other prickly trees.

The first night, at Getêna (63 miles), three *Noctuae* came to the steamer's lights, all Egyptian species: *Agrotis segetum*, *Caradrina exigua*, and *Sesamia cretica*.

The following day, Feb. 17th, I got a short two hours' collecting in the middle of the day at Ad Duwêm (125 miles, lat. 14° 10′ N.), but unfortunately much of this precious time was wasted in looking for good collecting ground. A female *Polyommatus baeticus*, two males of *Tarucus theophrastus*, and a male of *Azanus ubaldus*, were all Khartûm friends, as were *Belenois mesentina*, a male, *Teracolus daira*, one of each sex, and *T. protomedia*, also one of each sex. The last is a strong flyer, and some got away in consequence. I did, however, add one species to my list in the shape of *Teracolus halimede*, Klug, var. *leo*, Butl., of which a male was secured, but unfortunately I damaged its hind-wing in pinching it. Other captures were:—the common wasp, *Eumenes tinctor*, a female, as well as *Icaria cincta*, Lepel., also a female, quite a tropical form; the small Bee, *Osmia* sp.; the Chrysid *Parnopes viridis*, Brullé; the Fly *Agria nuba*; *Coccinella 11-punctata*, and the widely distributed *Utetheisa pulchella*, of which several were seen. That afternoon, further up the river, a

female *Xylocopa aestuans* came on to the steamer and was captured by Miss Marriage.

On the return voyage three days later (Feb. 20th), I got another two hours ashore at Ad Duwêm, from 8.45 to 10.45 a.m. Butterflies were fairly common in and near some gardens a short way upstream, but there was a strong wind and many of them were much torn. On this occasion *Danaida chrysippus* put in an appearance and I took a male, a fine specimen of the *alcippus* form with hardly any fulvous upon the hind-wing; it had the characteristic odour of the species strongly developed. The most conspicuous insect however was *Teracolus protomedia*, which was common enough, but not very easy to catch in the high wind, though I managed somehow to secure nine, all males. This butterfly seemed to be especially attracted by the red flowers of a *Caesalpinia* (Nat. Ord. *Leguminosae*) in one of the gardens; in three of the specimens I detected a scent, slight but distinct, which was noted at the time as "a somewhat unpleasant, stuffy smell," "a slight scent, scarcely agreeable," "distinct, dusty, hard to describe." The commonest butterfly would appear to have been *Teracolus daira*, of which I brought away five males and three females, one of the former being a dwarf, a female is recorded as having had a clove-pink scent, both in the field and at home. Of *T. halimede* I got one female; of *T.* (?) *liagore*, Klug, a male. This last must be a very rare species. Dr. Dixey told me that he had never seen a specimen, but he thought that my insect must be Klug's *liagore*.[1] I also took five males of *Belenois mesentina*, three of which had a slight, somewhat hay-like scent.

The flowers of *Parkinsonia* (Nat. Ord. *Leguminosae*) attracted, besides the common *Xylocopa aestuans*, and *Eumenes tinctor*, the large handsome grey, black and white Bee, *Podalirius nubricus*, Lepel., of which I secured one of each sex; in company with these was a *Podalirius* that Mr. Morice thinks likely to be the undescribed male of *P. incanus*, Klug, of which I seem to have taken the female in the suburbs of Khartûm at the same flowers.

Late at night we reached Kosti, 192 miles from Khartûm. This is the place that is often called after the name of the district, Gôz Abû Gûma. Quite a number of insects came to the lights of the steamer during the evening. Among them was *Cirphis loreyi*, a rarity in England, but common enough in Egypt. There were also two specimens (? males) of a *Trichiura* placed by Sir George

[1] Miss Sharp, "Monograph of Teracolus," 1901, p. 127, considers *T. liagore*, Klug, to be the dry-season form of *T. daira*, Klug, and Mr. Walter Rothschild seems to concur.

Hampson with *obsoleta*, Klug. My Egyptian specimens quite agree with those in the British Museum from Cairo, but the two from Kosti are identical with three from the Blue Nile, and differ from the others in being smaller, darker, and of a blue-grey instead of a reddish tint. Mr. G. T. Bethune Baker has since described this form as *Trichiura definita, sp. nov.*[1] [See Plate V., Fig. 3.] Then there was a little ochreous Noctuid, a species of *Antarchaea*, which is not in the British Museum, also a very distinct Lymantriid, a tiny moth nearly black, with an orange, black-spotted abdomen, which Sir George Hampson has described as *Euproctis xanthosoma, sp. nov.*, adding "very distinct from all other species known to me"[2] [See Plate V., Fig. 4]; also a *Schoenobius* and a *Chilo*, both of which appear to be new. With these novelties were the less remarkable *Endotricha consobrinalis*, Zell., and the very generally distributed *Hypsopygia mauritialis*, Guen., a species near the British *Pyralis costalis*, Fabr.

It is curious in how many places and under what different circumstances I have taken single specimens of *Acridium aegyptiacum*; here it came to light, accompanied by other Acridians and Crickets (not yet named), as well as by the Mantid, *Empusa egena*, Charp., and the Cockroach, *Derocalymma porcellio*, Gerst.

The huge, but dingy Water-bug, *Limnogeton fieberi*, Mayr, was accompanied by a number of Beetles, many of them obscure species that I have been unable to identify:—*Opatrum subsulcatum*, Reich., in some numbers; *Opatrum* sp.; *Tanymecus* sp.; *Taeniolobus* sp.; *Chlaenius* sp.; *Paederus* sp.; *Luciola* sp., not in the British Museum; and lastly a male of the common Ant, *Myrmecocystus viaticus*.

At our most southerly point, Gebel Ên (lat. 12° 40′ N.), 208 miles from Khartûm, I had a very short time for collecting. The thin scrub was extremely dry, there was scarcely any herbage, and but one or two shrubs were still in flower. The heat was intense, 114° F. in the shade, at the same time the sense of hurry was most disconcerting. Under these adverse conditions all that I succeeded in taking back to the ship were two Dragon-flies and six Butterflies. A male *Danaida chrysippus*, with the usual scent, differed from the type only in having the veins of the hind-wings margined with white; of two *Teracolus halimede* one had a large piece missing from a hind-wing; there were two *T. eupompe*, Klug; and, lastly, a *T. evarne*, Klug, the only specimen that I met with. All these *Teracoli* were males, and the two last-named species decidedly of dry-season type.

[1] *Ann. Mag. Nat. Hist.* (8), vii., p. 565 (1911).
[2] *Ibid.* (8), v., p. 487 (1910).

That night we slept at Roseires (not to be confounded with the place of the same name on the Blue Nile). Here again insects came to light, viz.: *Cirphis loreyi*, as before; the ubiquitous *Nomophila noctuella*; a yellowish Arctiid, superficially rather like a *Nonagria*, not known to Sir George Hampson; another specimen of the new *Antarchaea* previously taken at Kosti; a Lymantriid which Sir George Hampson considers to be the male of an undescribed female from British East Africa, and has described as *Laelia seminuda, sp. nov.*[1] [Plate V., Fig. 6.] With the moths came the Acridian *Oxycoryphus compressicornis*, Latr. The next morning a Mantid, *Calidomantis savignyi*, Sauss., was found on a water-lily on the breakfast table; doubtless it had been attracted by the lights the night before. Several Beetles also visited the lights—which, by the way, were acetylene, and not very brilliant:—*Coccinella rufescens*, Muls.; *Brachinus* sp.; *Ora* sp.; *Tanymecus* sp. (the same as at Kosti); *Paederus* sp.; and *Chlaenius* sp.

The next morning we left Hillet Abbas at 10.30 a.m.; it is a bare, miserable place, not improved entomologically by a tearing wind. However, besides three Dragon-flies, I managed to get hold of one *Azanus ubaldus*, a female; a female *Teracolus daira*; and two males of *T. halimede*. This last is a delicate insect, white with a cadmium-yellow flush; it appears to have a slight, somewhat disagreeable scent. Here I missed a Blue, probably *Polyommatus baeticus*.

On our way down stream again I got a short hour's collecting at Kosti in a small vegetable garden close to the landing place. Only two butterflies rewarded my efforts, a male *Zizera lysimon*, and a male *Danaida chrysippus*; the last, taken at Onion flowers, was almost typical, with merely a little white along the veins of the hind-wings. It proved tenacious of life and had the usual characteristic scent.

The flowers of Carrot yielded a female of the Scoliid *Elis senilis*, of which I had taken several males at Khartûm. When I first met with this in Egypt I had no notion that the sexes were conspecific. The male, very variable in size, is smaller, its abdomen orange-red, ringed with black, its head and thorax clothed with grey pubescence (whence the name), its wings are nearly transparent. The female is larger and stouter: the pubescence orange, abdomen blue-black, and about two-fifths of the wings purple. On the same flowers I took the beautiful *Eumenes lepelletieri*, Sauss., one of each sex, a fine yellow insect with a black cross on its abdomen; a pair of the yellow-eyed

[1] *Ann. Mag. Nat. Hist.* (8), vol. v., p. 441 (1910).

Tachysphex fluctuatus, Gerst.; a male of *Odynerus* (?) *bellatulus*, Sauss.; also a Pompilid, which puzzles Mr. Morice, but which he thinks may be *Salius bretonii*, Guér. There were also several Bees: a female *Nomia edentata*, Moraw., and four *Megachile* (?) *venusta*, Smith. With these was the Egyptian Grasshopper, *Chrotogonus lugubris*.

We stopped at Tawila (185 miles above Khartûm) to fill up with fuel. Fortunately, the process of "wood-ing" was a slow one, and I got ashore from 1.0 to 4.30 p.m. The terrain was covered with a scanty scrub just above the level of the river; the small trees were mostly Acacias, but all were exasperatingly thorny. Collecting was good, in spite of the wind, nearly all my captures being made at one or two late Acacias that were still in flower. The sense of hurry and the desire to catch as many things as the time permitted interfered with observation. In the midst of my work I tore my net very badly, but fortunately the steamer was not far off, and I ran back to get a new one; curiously enough, two of my best specimens were taken with the damaged net, in spite of a hole quite a foot across! Most of my captures were by this time old friends, *e.g. Tarucus theophrastus*, two males and a female; *Belenois mesentina*, a solitary male; *Teracolus protomedia*, a male with a sweet scent; *T. daira*, three males and two females, one of each sex was unusually large, but on the other hand one female was a veritable dwarf; *T. eupompe*, seven males and one female; *T. halimede*, var. *leo*, two males and one female.

But besides these old friends I made some new acquaintances, to wit, *Teracolus phisadia*, Godart, six of each sex. The male is very pretty and delicately coloured, being pink with a black border to the wings, one of them was noted as having a sweet, luscious scent; the female is sulphur yellow. I also got two *T. calais*, Cram., a Delhi acquaintance, one of them small. Of *Herpaenia eriphia*, Godart, I took one of each sex, both quite remarkably small specimens. Two old South African friends also turned up, *Leuceronia buquetii*, Boisd., a female, and three *Virachola antalus*, Hopff.

The only moth that I saw was *Sterrha sacraria*, Linn., which I kicked up. There were but two Aculeates in my bag: a male *Eumenes tinctor*, and a female *E. lepelletieri*.

Late that afternoon we stopped at Fachi Shoya, on Abba Island (176 miles above Khartûm), where the Mahdi used to live. I landed and collected from 5.15 p.m. till dusk. The following were for the most part disturbed from grass, etc.:—a nearly typical male *Danaida chrysippus*, only slightly dusted with white; it was tenacious of life

and had the characteristic scent; five females of *Teracolus halimede*; also a female of *T. eupompe*, lacking the red tip. It is notable that at Tawila, *earlier in the day*, males prevailed over females. The female of *halimede* is variable, the ground colour is usually white, but in a specimen from Ad Duwêm it was yellow; sometimes there is a mere trace of the yellow flush, but occasionally it approaches that of the male; moreover, the black markings vary in intensity.

At Fachi Shoya I got a single moth, a Lithosiid, which is almost certainly a new species. A native sailor brought me two beetles, *Rhytidonota scabriuscula*, Esch., and Mrs. Longstaff found a beetle in our cabin, *Pheropsophus* (?) *lafertei*, Arrow. That night there was a violent gale from the north, which blew out of my cabin two of my precious Tawila butterflies in their papers. What they were I shall never know, but have an impression that they were *Teracoli* of which I had others. In spite of the gale a Catocaline Noctuid came to light, *Pandesma quenavadi*, Guen., a common Indian form.

On my last night on the White Nile, Feb. 20th, above Geteina, *Blattella (Phyllodromia) treitliana*, Wern., an uncommon Cockroach, came to light, and Herr Schwabacher gave me a *Cirphis loreyi*.

The fauna of the Sûdân is extremely interesting from the point of view of geographical distribution. The Sûdân may indeed be compared to Switzerland, in which country French, Germans and Italians meet. The insect fauna of Egypt is essentially Palaearctic in character; the great majority of its insects are also to be found in Southern Europe. As examples of Palaearctic species extending through Egypt to the Sûdân the following may be mentioned:—*Cirphis loreyi*, *Euxoa spinifera*, *Caradrina exigua*, *Deilephila livornica*, *Xylocopa aestuans*, *Eumenes tinctor*, and *Coccinella* 11-*punctata*.

Another element is the Oriental, which would appear to have reached the Sûdân through Persia by way of Arabia. Such insects are *Teracolus calais*, *Pandesma quenavadi*, *Noorda blitealis*, *Arnipses sabella*, and *Copicucullia sublutea* (though perhaps this last may be reckoned as Palaearctic rather than Oriental).

Other Sûdân insects have a far wider distribution, such as *Danaida chrysippus*, *Polyommatus baeticus*, *Zizera lysimon*, *Utetheisa pulchella*, *Eromene ocellea*, and *Sterrha sacraria*. Together with these are the almost cosmopolitan *Pyrameis cardui*, *Agrotis ypsilon*, and *Nomophila noctuella*.

Though doubtless many, if not all, of these common insects are to be found in Uganda, yet the fauna of that country may well be considered as characteristically Ethiopian. From Uganda not a few Ethiopian species have passed to the Sûdân, where they meet the

Palaearctic and Oriental insects previously named. Such are *Papilio demodocus*, *Catopsilia florella*, *Leuceronia buquetii*, *Herpaenia eriphia*, *Calopieris eulimine*, *Teracolus protomedia*, *T. daira*, *T. chrysonome*, *T. ephyia*, *T. kalimede*, *T. phisadia*, *T. eupompe*, *T. liagore*, and *T. evarne*, *Virachola antalus*, and *Lamoria imbella*.

So far as my slight opportunities enabled me to hazard an opinion, the Palaearctic fauna of Egypt extends almost unchanged as far south as Wâdî Halfa. It would, of course, require much study on the spot to define the line, if such there be, north of which Ethiopian species do not range. The line of demarcation may safely be assumed to be different for different species. For instance, the African butterfly, *Catochrysops cleusis*, is as abundant at Abu Simbel in Nubia, and even at Aswân, as it is at Khartûm; one or two Sudanese moths also, as I have mentioned, extend into Nubia; nevertheless I was distinctly impressed with the idea that it was south of the Nubian desert, roughly speaking at the river Atbara (say 17° 30′ N.), that I first came in contact with the Ethiopian fauna, though, on the other hand, forms which occur in the Palaearctic Province were common enough at Khartûm and even south of it, but these were for the most part wide-ranging, if not actually cosmopolitan species.

The Hon. N. C. Rothschild stayed for some time at Nakheila, on the Atbara, in 1904, where he and his companions, the Hon. F. R. Henley and Mr. A. F. N. Wollaston, took several species of *Teracolus* and other insects that I met with at Khartûm or south of it.[1] Mr. Rothschild informs me that he thinks the *Teracoli* probably extend as far northwards as the thin Acacia scrub, that is to say, to some point north of the Atbara, but south of Wâdî Halfa.

It is interesting to compare with my captures those of Mr. W. L. S. Loat, F.Z.S.,[2] in 1901 and 1902. Many species are common to the two lists, but not only had he somewhat more time than was at my disposal, but a large number of his insects were taken as far south as lat. 5° N., whereas I did not get beyond 12° 40′ N.; it was therefore only to be expected that, as compared with my captures, his were more strongly Ethiopian, including, *e.g.*, a *Neptis* and two species of *Acraea*. Mr. Loat took 11 species of *Teracolus*, I took 10; six species are common to the two lists.

As regards the Hymenoptera Mr. Morice writes me: "I may say that the only insects I had previously examined from Khartûm and the White Nile, were those taken by the Swedish expedition five

[1] *Novitates Zoologicae*, 1905, vol. xii., pp. 21, 22.

[2] "On Lepidoptera from the White Nile," by F. A. Dixey, M.D., F.R.S., *Trans Ent. Soc. Lond.*, 1903, p. 141.

or six years ago, and you have certainly got much more material than they did—though, strange to say, hardly any of the same species!"

February 22nd.—On my return journey, at Atbara Junction (lat. 17° 35′ N.), I took a male of *Rhynchium niloticum*, a red and black Wasp whose acquaintance I had made at Khartûm.

At Abû Hamed (lat. 19° 30′ N.) I made a raid upon the station-master's garden and picked up a female *Philanthus variegatus*, a common Khartûm insect which I did not meet with north of this, although I am told that it is a North African species; also two females of *Nomia latipes*, Moraw., a Bee that I did not come across elsewhere; and a female of *N. edentata*. A Dragon-fly and a Grasshopper are still unnamed.

February 23rd.—The common *Euxoa spinifera* came to light at Wâdî Halfa.[1]

NOTE ON THE LAND AND FRESHWATER MOLLUSCA OF THE SÛDÂN.

By Mrs. G. B. Longstaff.

The dearth of land Mollusca in Egypt and the Sûdân offers a marked contrast to their abundance in Jamaica. This is to a certain extent atoned for by the numbers of freshwater Mollusca occurring in the Nile, numbers, however, of individuals rather than of species, for many species range with but slight variation over considerable distances. Possibly, indeed, if individuals from districts still more remote could all be brought together, it might be found that some now regarded as distinct species would prove to be but several links in a chain of the varieties of one form.

The Mollusca here recorded were collected at the mouth of the White Nile near Mogran, as well as at various points where the steamer stopped during a five days' trip from Khartûm to Gebel Ên and back. The month of February seemed a most favourable time, since the river was subsiding and many specimens were found at its margins either alive or quite recently deceased. The only land shell taken was *Limicolaria flammea*, Müll. The largest specimen, which is of the variety *sennaariensis*, Parreyss, was found by the obliging manager of the steamer, Mr. Macdonald, on a hill at Gebel Ên. It agrees very nearly with Fig. 5 on Pl. vi. of "Fauna der Land und Süsswasser Mollusken Nord-Ost-Afrika," by C. F. Jickeli. Three shorter shells were met with which greatly resemble the var.

[1] This account of the Sûdân appeared in the *Entom. Month. Mag.*

numidica, Reeve, as represented in Fig. 7 on the same plate. Two of these occurred at Hillet Abbas and the other at Fachi Shoya. All the specimens were dead with only portions of the epidermis preserved.

Two living examples of *Succinea rugulosa*, Morelet, were found on water plants ("umm Sûf") at the edge of the White Nile at Gebel En. The Swedish zoologists in 1901,—and they were the first to record it from tbis district,—also took but two specimens, at Gebel Ahmed Agha, a little further south. Theirs, however, are much smaller than mine, which come nearer to the type in dimensions, one of them being 8 mm. in length and 4·5 mm. in width. They were likewise the first to take at the same locality *Isidora sericina*, Jickeli, which had previously only been recorded from districts north-east of Abyssinia. They, however, got but one small specimen, whereas I took six, one at Gebel Ên and five at Hillet Abbas, four of which were alive, and the first if not alive when taken was quite recently dead. Again my largest is nearer the type in size than theirs as it measures 9·5 mm. in length and 6·5 mm. in width. All were on water-plants. Another species which the Swedes were the first to record from the White Nile, *Planorbis boissyi*, Pot. & Mich., was taken by me at Gebel Ên (six), Hillet Abbas (four) and Fachi Shoya (two); they were on the mud aud were mostly in good condition, but only one was alive. I found eight living specimens of *Melania tuberculata*, Müll., near Mogran, and kept them alive for a time to observe their movements: the animal advances slowly and then brings its shell forward with a jerk. R. Hägg only mentions one of this species, which was met with at Mahmudia some forty miles further south.

The largest example of *Ampullaria kordofana*, Parreyss, was taken at Kosti. It was dead but the epidermis was well preserved; the length measures 66 mm. and the width equals 56·5 mm. Three smaller shells were found at Gebel Ên, two of which were alive; three at Tawila, two of which also were alive; and one at Hillet Abbas.

A muddy creek among water-plants at the latter place was especially productive, and here I took my finest specimen of *A. wernei*, Phil., its length equals 93 mm., and its width, 95; another is nearly as large; these and several of smaller dimensions were alive. This species was also taken at Gebel Ên, Fachi Shoya and Tawila.

Lanistes bolteni, Chem., occurred at Gebel En, Hillet Abbas, Fachi Shoya, and Tawila, altogether about thirty examples were found, of which only seven were living.

Numerous specimens of the variable species *Cleopatra bulimoides*, Oliv., were taken. Those from Mogran were the largest and had the

most convex whorls; out of one hundred and ten only five, and these immature, had a keel on the spire, this was observed on very few adults and on one only was it continued on the body whorl (var. *uniliata*, Germain). They were nearly all of a uniform yellowish horn-colour, with the exception of nine which had dark brown spiral bands, these included the five keeled young shells. At Gebel Ên about forty individuals were found which were greatly decollated, whereas those at Mogran were only slightly so. The southern specimens are less robust and have a smaller spiral angle. Thirty-three are spirally striped with dark brown, only eight are self-coloured similar to those found near the mouth of the river, and three of these have a keel on the whorls of the spire. Fourteen of the striped shells have two keels on the spire, which are not continued on the body whorl (var. *bicarinata*). Ten individuals were met with at Hillet Abbas, which are also decollated, five are unicolorous, the rest have dark stripes. Four have keels on the spire.

Vivipara unicolor, Olivier, which is equally variable, was found at all the stopping places and also near Mogran. Those from the latter locality have almost convex whorls with but little trace of angularity, whereas one taken at Gebel Ên, as well as those met with at intermediate places, are distinctly biangular (var. *biangulata*, Küst.). Some have in addition several spiral moniliform threads, these are especially clearly exhibited on a shell from Hillet Abbas, which thus approaches the var. *robertsoni*, Frauenf.

I did not find specimens of *Corbicula* so numerous in the White Nile as lower down at Aswân, nevertheless I met with individuals characteristic of two of the three groups into which M. Pallary divides the species. At Gebel Ên were found three good specimens of the triangular form, *C. artini*, Pallary, and at Hillet Abbas three much worn single adult valves, and two young living examples. *C. consobrina*, Caill., occurred at these two localities as well as near Mogran. A single valve taken at Hillet Abbas is the largest, measuring 31 mm. in height, and 34 mm. in width.

Numerous specimens of *Sphaerium sp. indet.*, were obtained at Gebel Ên, Hillet Abbas, Fachi Shoya, and Tawila.

Both an adult and a young example of *Nodularia* (?) *parreyssi*, v.d. Busch, were found at Fachi Shoya. Eight individuals in different stages of growth, though none quite mature, were also taken at Mogran. At Sobâ on the Blue Nile there occurred five specimens which closely agree with Pallary's figures of *N. mysticus*, Bourg. A very good example of *N. aegyptiaca*, Fér., was found at Hillet Abbas, and two larger, thinner, and more orbicular specimens were met

with at Tawila and near Mogran respectively. *N. teretiuscula*, Phil., var. *lithophaga*, Zieg., was fairly abundant, occurring at Hillet Abbas, Fachi Shoya, Tawila, and near Mogran. Specimens of a species resembling the last but higher in proportion to the width and less attenuated posteriorly were taken at Tawila, Ad Duwêm, and near Mogran, these last were greenish and not so dark in colour as the others, which were nearly black.

Seven examples of *Mutela nilotica*, Fér., var. *angustata*, Sow., were found near Mogran. The largest has a width of 120 mm., height at the umbo 42 mm., greatest height 48 mm. There were also met with here three immature individuals of the var. *elongata*, Sow., agreeing with Germain's figure of *M. moineti*, Bourg. Eight specimens of *Mutelina rostrata*, Rang., were taken at the same locality. A recently killed example of *Spatha rubens*, Lam., var. *cailliaudi*, von Martens, was obtained from a fishing boat at Kosti, as well as a single valve of a larger specimen. At Fachi Shoya I found the right valve of a species which seems to agree with *Spatha marnoi*, Jickeli.

Three fine specimens of *Aetheria elliptica*, Lam., of the typical form, were taken at Tawila. They were adhering to one another and contained the animals, they are devoid of tubular spines and are more or less oval in contour. A valve with the broken hinge of the other attached, similar to the preceding, was found at Gebel Ên. At Fachi Shoya I met with a smooth valve fixed to two spiny ones (var. *tubifera*, Sow.). This large bivalve is so like the common Oyster that one was astonished to find it in a river at such a great distance from the sea. Like the Oyster it is not only variable but extremely irregular in form; it is gregarious, occasionally forming, we were told, such rocky masses as to be an impediment to navigation.

I am greatly indebted to Mr. Edgar Smith for help in comparing my specimens with those in the Natural History Museum. The works of M. Pallary have been of considerable service, and I have in the main followed his classification.

EGYPT.

February 24th—April 18th, 1909.

The return voyage down the Nile was a come-down in other senses, and it was difficult to keep up much entomological enthusiasm. Moreover, as I began to despair of finding insects of much interest, the marvellous history of the country as depicted in tomb and temple

became more and more absorbing, till I felt—as so many have done—that to linger in the country or to return to it would mean to become a "digger."

Aswân.

February 25th.

Most of my time was spent in revisiting the oasis near the golf-links. It was a cold morning, 62° F., with a strong wind. In sheltered places, especially about Crucifers, *Pyrameis cardui* was abundant, many of the specimens were fresh though chipped, several —practically all that were settled on the ground—were seen to orient. *Polyommatus baeticus* was common; *Tarucus theophrastus* was not uncommon at orange-blossom. This same bridal flower, growing near a Sâkyeh or water-wheel, also attracted *Eumenes tinctor* and *Elis senilis*—although the name of the latter would have suggested that it should be beyond such romantic food. A male *Podalirius* near to *albigena*, and a female *Megachile flavipes*, were satisfied with such less overpowering sweets as *Raphanus* affords, and though I found the Chafers less common than before, our old friends *Myrmecocystus viaticus* and *Adesmia* (?) *cothurnata* were still coursing over the sand, and *Mesostena laevicollis* and *Pimelia spinulosa* still hid under stones.

That night the vessel's lights were visited by *Agrotis ypsilon*, *Euxoa spinifera*, and *Sesamia cretica*.

Luxor.

February 26th—March 9th.

One day a severe sandstorm made everything impossible, and I varied my entertainment by spending three days in bed: a very rare experience. My time in the neighbourhood of the ancient capital, Thebes, was mainly devoted to the engrossing study of Egyptology. The following story, told me by a German fellow-traveller of his quite recent personal experience, shows how ill-equipped some persons are for such a journey. Herr S. noticed that a certain lady (at least a first-class passenger) did not seem to take in the words of the dragoman expounding Dr. Budge at second-hand. Out of kindness he essayed to help her by explaining the general principles of the ancient picture writing, and pointing out some of the commoner hieroglyphs. He quite thought that he had made some progress, and

that the lady was getting really interested, when she suddenly broke out with, "Yes, I suppose they are all quotations from the Koran."

Such entomological efforts as I did make at Luxor were but poorly requited, and I can recall few districts less productive than the Theban plain. The hotel garden harboured a very few *Tarucus theophrastus*, and they were in bad condition. From time to time a White gave me a desperate chase, and after many efforts I secured one—a female *Ganoris rapae*, Linn. To the south of the town I picked up odd examples of *Catochrysops lysimon* and *Tarucus telicanus*, and saw *Pyrameis cardui*.

The Aculeates met with were *Xylocopa aestuans*; *Colletes braccatus*, a Bee that was abundant at mignonette flowers; *Megachile flavipes*; the Wasps, *Sceliphron spirifex*, *Eumenes tinctor*, and *Vespa orientalis* at flowers of carrot; with these was a *Myzine* (?) *aegyptiaca*, which I had also taken at Khartûm.

The large garden of the hotel also yielded the big red Locust, *Schistocerca peregrina*, *Coccinella* 11-*punctata*, *Ocnera hispida* and the Syrphid fly, *Eristalis taeniops*.

But if the days were unproductive it must be admitted that the nights were less so, and the moths about the electric lights kept me busy on the terrace of the hotel. Most of the Noctuids were by this time old friends: *Agrotis ypsilon*, *A. segetum*, *Euxoa spinifera*, *Cirphis loreyi*, *Caradrina exigua* (in some numbers), *Sesamia cretica* and *Spodoptera mauritia*; the same is true of *Craspedia consentanea*, *Tephrina disputaria*, *Deilephila livornica*, *Trichiura obsoleta*, *Nomophila noctuella*, and *Eromene ocellea*. There were, however, a few newcomers, of which the most conspicuous, or at least the most numerously represented, was *Plusia circumflexa*, Linn. (a near ally of our *P. gamma*, which it closely resembles), an insect which ranges over Southern Europe and a great part of Africa. The Catocaline, *Pseudophia haifae*, Habditch, is an insect that has been but recently described from Alexandria, and the National Collection possesses but one specimen; unfortunately only one visited my hotel. A much more conspicuous thing was the handsome *Taragama acaciae*, Klug; I have little doubt that the stripped branches and unsightly webs which I saw on the Acacias at Aswân and elsewhere were the work of the larva of this Lasiocampid.

Other insects found about the lights were the Carabid, *Chlaenius brahminus*, Laf., the once revered *Scarabaeus sacer*, and a Mole-cricket, *Gryllotalpa africana*, Pallas.

March 11th.—At Baliana (lat. 26° 15′ N.), on the Abydos road, a number of *Ganoris rapae* were seen in and about the fields; an obscure

Heteromeron crawled in the Temple of Seti, quite unconscious of the superiority of the earlier carvings to the later which so sadly deface them. At night *Sesamia cretica* and *Plusia circumflexa* came to the steamer's lights, accompanied by *Endotricha consobrinalis*.

March 12th.—At Asyût I did not see a single butterfly, and sweeping produced nothing more exciting than *Coccinella* 11-*punctata*, *Megachile flavipes*, and *Apis mellifica*; while *Vespa orientalis* occurred in the little public garden.

Abû Fêdah (lat. 27° 30′ N.). The steamer's lights brought together a number of *Cirphis loreyi* and a Lamellicorn beetle, a species of *Pentodon*, represented at South Kensington, but not named.

March 13th.—At Tel-al-Amarna (lat. 27° 37′ N.) the insects met with—*Tarucus telicanus*, *Xylocopa aestuans*, and *Chalicodoma sicula*—fell far short of the wall paintings in interest. It may, however, be noted that this was my northernmost locality for the Blue, at least in Africa, for in 1903 I took it at Lahore (lat. 31° 35′ N.).

Near Matâi (lat. 28° 26′ N.) the steamer ran aground at a very narrow place where the difficulty of navigation was considerable and the stream strong. The current striking the stern of the vessel on the port side swung it right round, and, there not being room enough, literally brushed off the rudder against the bank. The turning movement had liberated the bows and the Râiz (pilot) managed to anchor in a convenient bay a little lower down where there was less current. To these river steamers the loss of a rudder is such an ordinary occurrence that they carry a spare one, and it did not take the engineers many hours to clear away the wreckage and ship another.

A few insects came to the lights of the disabled ship: many *Agrotis ypsilon*, several *Euxoa spinifera* and *Cirphis loreyi*, a few *Nomophila noctuella*. A couple of *Scarabaeus sacer* turned up, but I was more surprised to see *Schistocerca peregrina*. While in pursuit of moths I boxed a specimen of the blood-sucking fly, *Hippobosca francilloni*, Leach, off the face of a fellow-passenger.

Arabic is a difficult language: I am told that it is related to Hebrew, but it has little or nothing in common with Aryan tongues. A puzzled student once waggishly said that in Arabic every noun-substantive had three meanings:—

1. Its own proper primary signification.
2. A secondary signification the exact opposite of the first.
3. Some sort of camel.

A clergyman coming down the Nile told me that he was greatly

interested in the religious stories and traditions of the Arabs, and his cloth must be my excuse for quoting two of them.

(*a*) When the Creator had made the Camel, he looked at it—and laughed. Then he looked at it a second time—and laughed again.

(*b*) The reason why the Camel is the most supercilious of all creatures is this—

Man knows the ninety-nine attributes of God, but one thing he does *not* know—the Ineffable Name, that graven upon the seal of Solomon—*but the Camel does.*

CAIRO AND DISTRICT, lat. 30° N.

March 16th—April 18th, 1909.

CAIRO is of course a city of extraordinary interest, and it is interesting from many points of view, but as regards insects it cannot be termed a great locality, while as far as Lepidoptera are concerned my efforts were almost fruitless.

Danaida chrysippus appeared to be over, at all events for the time, but, on the other hand, *Ganoris rapae* had come out since my first visit and was fairly common about the fields of Barsîm, the Egyptian white clover; it was also to be seen in the beautiful gardens at the Barrage, gardens so highly cultivated as to produce nothing but the Small White and the ordinary form of the Honey-bee. On March 30th, I saw a male of *Colias edusa*, in the garden of the Gezîra Palace Hotel, where Mrs. Longstaff found a specimen of *Spodoptera mauritia* sitting on her parasol, and where *Plutella maculipennis* condescended to come to light.

One day I took train to Matarîya, about seven miles to the north-east of Cairo. Near the station a solitary *Polyommatus baeticus* was netted, and such common things as *Polistes gallicus*, Linn. (which also occurred on Gezîra Island), *Myrmecocystus viaticus*, *Coccinella 11-punctata*, and *Epicometis squalidus*, the last on *Raphanus*. However, my objective was the Rev. F. D. Morice's old collecting ground, the banks of the abandoned railway to Suez; so I struck out to the right across the desert, but, owing to the early date, March 24th, and the exceptional dryness of the season, did not find either flowers or insects very plentiful, moreover the wind blew as it usually does in Egypt.

A few *Synchloë glauconome*, Klug, coursed swiftly along close to the ground; a Painted Lady was the only other butterfly, and I saw no moths. The black spider-like Heteromeron, *Adesmia dilatata*,

Klug, was to be seen running at a moderate pace in all directions; *Tentyria glabra*, on the other hand, is a comparatively sluggish insect found under stones. The little *Zophosis complanata*, Sol., is exceptionally swift in its movements, curvetting about so as to give much trouble to its would-be captor. It frequented desert plants, from which, when disturbed, it would make short excursions on to the open sand, returning again to its shelter. The integuments of this beetle are hard and brittle; in the cabinet it appears as a uniformly black insect, but on the desert closely approximates in colour to the sand, being dust-coloured, with a tendency to red, but sometimes appearing almost white in the bright sunlight. This colour is due to a coating easily rubbed off by the fingers, disappearing entirely in the cyanide-bottle; it seems to consist of an excretion, perhaps waxy in its nature, to which probably the finer dust of the desert adheres and gives the last touch to its cryptic colouring.[1] Under stones an *Ocnera hispida* turned up, as well as another species of the same genus. The Ant of the place was an *Aphaenogaster*, which Mr. Morice thinks may be a race of *barbara*.

On the Mukattam Hills, above the Citadel, hills of white limestone built up mainly of Nummulites and other fossils, I found under stones the common *Ocnera hispida*, *Micipsa grandis*, Kraatz, and three specimens of a species of *Adesmia*. Inside the Citadel itself I found a worker *Myrmecocystus viaticus* carrying a brother in his mandibles.

The most promising locality that I visited was the Wâdî Hof, a few miles to the East of Helwân. This is a winding gorge cutting through the limestone hills, bounded on either side by steep cliffs, but without any stream at the bottom. These gorges are one of the puzzles of Egypt, and seem to point to a time when rain was much more abundant than now, for it seems very difficult to suppose that such rain-storms as undoubtedly occur from time to time can have performed such extensive works of excavation. At the bottom of the Wâdî there is little sand, but many stones. Small slender Lizards, exactly the colour of the ground, were to be seen in abundance running swiftly along with their heads held high. Vegetation was more varied and more abundant than one at first imagined; it would have been delightful to have had more time there, and especially to have visited it later in the year or in a less dry spring. However, I succeeded in netting that regular desert insect, *Melitaea didyma*, Esp., f. *deserticola*, Oberth., which I had previously taken in a somewhat similar locality near Biskra. Another specimen was unfortunately

[1] See above, p. 168.

missed, as was a White which, so far as I could see, was probably *Synchloë glauconome.* Hovering at the flowers of the Labiate, *Stachys aegyptiaca*, Pers., and by no means easy to net, were two Bees, *Podalirius suworzevii*, Moraw., and another larger species of the same genus; and yet another *Podalirius* coming very near to *albigena.* The only other bee was a female *Megachile argentata.*

At the flowers of *Zygophyllum coccineum*, Linn. (Nat. Ord. *Zygophyllaceae*), and also on the wing, I took several of the Buprestid, *Psiloptera argentata*, Mann, while the Heteromeron, *Micipsa grandis*, was found under a stone.

The Fly, *Agria nuba*, was not uncommon. On the flowers of *Ochradenus baccatus*, D.C. (Nat. Ord. *Resedaceae*), I took a couple of what Mr. E. E. Austen says is probably a new species of *Urellia*—a tiny fly with green eyes, its wings beautifully netted with a sharp black pattern. At the same flower was an undetermined bee.

Two Acridians, *Poecilocerus bufonius*, Klug (of the sub-family *Pyrgomorphinae*), complete my list.

Somewhat similar to the Wâdî Hof is the Wâdî Abû Roâsh on the western side of the Nile, about six miles north of Mena, but its vegetation seemed less varied. My first visit was interfered with by a sandstorm, an interesting sight but a disagreeable one. When the wind is strong enough and blows in a suitable direction, the sand is swept up into the air, so that the sky is darkened, and may even become as opaque as in a London fog, putting a stop to all navigation on the Nile.

At Abû Roâsh I saw but one butterfly, almost certainly a Painted Lady, neither did I capture a single moth; it is, however, only fair to the locality to mention that it was a windy day. Perhaps the insects that interested me most were the lovely little *Chrysis fasciolata*, of which I secured a dozen, some of the blue, but the majority of the green form. Then there was the black, grey-banded *Mutilla (Dasylabris) arabica*, Oliv., as well as the nearly allied *Apterogyna olivieri*, Klug. The only ant brought home was *Myrmecocystus bombycinus*, Rog. A male of the elegant slender *Sphex nivertus*, Dufour; a *Celonites mongolicus*, Moraw.; a female *Miscophus ctenopus*, Kohl, and several Pompilids were among my captures; the *Miscophus* and the Pompilids frequently settled on the sand, but were often driven off for a yard or two by the strong wind. A male *Eumenes nigra*, Brullé, was a more powerful insect, as was also *Vespa orientalis*, of which two females appeared to be feeding on the hollow receptacle of the Composite *Echinops spinosus*, Linn.

An unnamed species of *Larinus*, a Weevil, was found on the last-named plant; it is somewhat cryptic, but its yellow pubescence is apt to come off upon the fingers. The common Ladybird, *Coccinella 11-punctata* also haunted the *Echinops*, so it may reasonably be assumed that the plant harboured an *Aphis*, which may have attracted the Wasp also.

The large, conspicuous *Nemestrina lateralis*, Wied., occurred on flowers of *Centaurea aegyptiaca*, Linn. (This fly was also taken on Gezîra Island at *Lantana* flowers.) I also took another *Bombylius*, as yet undetermined.

Leaf-cutter-bees were fairly numerous at the flowers of *Centaurea* and *Echinops*, especially the former. The little *Megachile flavipes* was quite common, but I took only one *M. mucorea*, Friese. I also got a *Podalirius* that comes near to *albigena*.

A couple of the swift dust-coated *Zophosis complanata* were all that I saw. The odoriferous carcass of a Jackal gave shelter to a *Saprinus* which is not represented in the British Museum.

At Abû Gurâb, about six miles south of the Great Pyramid, in a part of the ruined brick-work known as "The Boat of the Sun," there was an evidently urinous spot in the sand, and the rain of the day before caused it to emit a strong ammoniacal odour. This proved very attractive to Hymenoptera, and in a very short time I captured three *Chrysis fasciolata*, a *Megachile flavipes*, and a number of *M. mucorea*, all females. With these was a Bee with a conspicuously red abdomen, *Paracoelioxys rufiventris*, Spin., of which Mr. Morice wrote to me (December 9th, 1909):—"*P. rufiventris*, I believe, since Spinola described it, has only been found once (by myself and Schmiedeknecht) —sitting on the Great Sphinx! You have also its host, *Megachile mucorea*, which we discovered on the same occasion, both host and parasite in considerable numbers."

Late one lovely moonlight night I explored the interior of the Pyramid of Chephren, and at the bottom of the descending passage, 105 feet from the entrance, found an *Ocnera hispida* crawling on the floor. One day at Oxford, Dr. Dixey, talking to a group of entomologists in my hearing said, "*Cardui*, oh! that is the sort of thing that you would expect to find on the top of the Pyramid, and if any-one ever *does* discover the North Pole he will probably find a worn specimen of *cardui* hybernating upon it." I have not yet visited the North Pole, and should scarcely hope to find *cardui* there if I were foolish enough to direct my steps in that direction, but not very long before the conversation in question, I *did* go up the Great Pyramid, and as I reached the top a butterfly flew off. With some difficulty I

induced the numerous Arab guides and hangers-on to sit still and make no attempt to catch it. The butterfly returned, as I had expected, more than once, and at length settled; there was no longer any question as to its identity—*Pyrameis cardui!*

The sole butterfly that I saw on the desert round the Pyramids was a *Polyommatus baeticus*, netted near the Sphinx.

At the Mena House the wire gratings erected to exclude mosquitos, excluded also moths, so that they were a mitigated blessing like the Irishman's well-meant remark to his friend:—" Faith! Pat, it's a good bhoy that ye are, and may ye be long in your grave before the Divil finds out that ye're dead!"

As a result of the "blessed" netting the only moth that reached the lights was a common Agrotid.

In the cultivated land just below the hotel garden *Ganoris rapae* was common, there were also a few Aculeates; the little *Philanthus triangulum*, the yellow and black *Eumenes coarctata*, Linn., var. *mediterranea*, *Podalirius atro-albus*, Lepel., and another species near to *senescens*, Lepel. Moreover *Coccinella 11-punctata* was again in evidence. Mrs. Longstaff, when hunting for Mollusca, found a *Chrotogonus lugubris* on the canal bank alongside the Gîza Road.

The garden itself, though frequently visited, did not afford much variety: a *Harpalus* was found under a stone; *Erodius puncticollis*, Sol., crawling upon the ground; a *Saprinus*; several *Myrmecocystus bombycinus*; the Mantis, *Hierodula bioculata*, was taken running on the ground under a *Eucalyptus* tree by day, while *Scarabaeus sacer* was picked up at night. Among the things taken on the wing the only species yet named are *Elis senilis* and a Clerid, of a carnivorous genus, *Trichodes angustifrons*, Abeille (? *crabroniformis*, Fabr.).

In the hotel itself Mrs. Longstaff found *Opatrum subsulcatum*, and the Syrphid fly, *Catabomba albomaculata*, Meig.

On the Nubian Desert ants are nothing like as numerous, either as regards species or individuals, as they are at Biskra, or in South Africa, indeed I saw none near Mena save a few *Aphaenogaster arenaria*.

A female Pompilid was taken at Wild Mignonette (*Reseda* sp.) a little to the south of the Pyramids; the small *Scolia interstincta*, Klug, was found in the desert; *Philanthus triangulum* occurred in the Granite Temple; of *Ammophila erminea*, Kohl, three females were taken settled on the sand with the abdomen held high in the air; of *Odynerus* (?) *dantici*, Rossi, a female was found on the higher desert, and *Eumenes nigra* near Abû Roâsh. On the desert near the Sphinx I saw a long pale insect flying swiftly close to the sand on

which it often settled, it was only after several attempts that I succeeded in catching it, when it proved to be *Bembex chlorotica*, Spin. A female *Vespa orientalis* was taken in the recently excavated Temple of the Pyramid of Mykerinos.

Xylocopa aestuans occurred on the desert near the Sphinx as well as on Gezîra Island. A stylopized female of *Andrena ephippium* was taken settled on the sand; *Apis mellifica*, for some reason best known to itself, haunted the Granite Temple of the Sphinx. The large and handsome *Podalirius fulvitarsis*, Brullé, was met with near Mena; while *P. suworzevii* was taken at flowers of *Hyocyamus* (?) *muticus*, Linn. (Nat. Ord. *Solanaceae*), a little to the south of the Sphinx.

Prominent among the desert beetles was *Ocnera hispida*, though it generally concealed its hard body under a stone, whereas *Pimelia spinulosa* often ran boldly in the open. An allied beetle, *Prionotheca coronata*, Oliv., found under stones just above the hotel, is distinguished not only by its coronet of curved spines—like bramble-thorns—round the sides of its abdomen, but by a copious brown pubescence. Other Heteromera were *Tentyria glabra* and *Mesostena laevicollis*, beetles that hide themselves, whereas *Zophosis plana* has the habits of its congener, *Z. complanata*. Some specimens of the *Mesostena* were found ten or twelve miles into the desert.

The handsome Carabid, *Anthia marginata*, Dej., was not uncommon under stones on the higher desert, above the Pyramids; this species occurred also at the foot of Gebel Dixon twelve miles to the west; but the pretty *Graphipterus variegatus*, Fabr., a beetle with soft integuments, ran freely over the sand in the sunshine: it is swift in its movements, doubling smartly. It can make a creaking or rustling sound, which seemed to me to be produced by rubbing the femora against the edge of the elytra, or possibly the edge of the abdomen.[1] I also saw this species at Sakkâra.

The very hard Weevil, *Pychnodactylus* (*Cleonus*) *tomentosus*, Fåhr., was found near the Sphinx in a hole in a limestone rock covered by a stone. *Scarabaeus sacer* was to be found about dung, or under stones, among them was a specimen of *S. compressicornis*, Klug, an Arabian species of which the British Museum has one specimen from the Fayyûm, but it would appear to be scarce in Egypt. I may now record, with not a little pride, that, about a mile south of the Great Pyramid (in such a case one should be precise) I found a *dead donkey!* It is disappointing to have to add that associated with it I found nothing more remarkable than an obscure *Saprinus*;

[1] See R. I. Pocock, *Ann. Mag. Nat. Hist.* (7), x., pp. 154–158 (1902).

however, Mr. Arrow says that the species is not represented at South Kensington.

Orthoptera were less common than might have been expected, but *Truxalis nasuta*, Linn., was among the denizens of the desert. One afternoon, when walking near the Third Pyramid with an unscientific acquaintance, he followed my example by turning over a stone, and forthwith, in accordance with the well-known law regulating such matters, unearthed something that I had myself not come across even in turning many stones, viz. two Cockroaches, *Polyphaga africana*, Linn., which (when alive) were of a pale sandy colour. A few minutes later this gentleman's wife called Mrs. Longstaff's attention to something running very swiftly in a straight line over the smooth sand. Greatly to our friends' amusement my wife pursued the creature at high speed, ultimately effecting its capture. It turned out to be the Mantid, *Eremiaphila hralili*, Lefebvre, new to the Hope Collection. During the whole of my time in Egypt I had been, at Mr. W. F. Kirby's special request, on the look-out for examples of that little-known genus. Apart from its swiftness of foot, the insect is almost white when alive and in the highest degree cryptic.

A good many fossils might easily be obtained in the Cairo district. The Mukattam Hills above the Citadel are of Eocene limestone, full of fossils, and, as is well known, Nummulites may be picked up off the sand at the foot of the Great Pyramid (which is indeed to a great extent built of those Foraminifera), while a couple of miles to the south a valley cutting into the escarpment exposes Miocene beds that are extremely rich in fossil remains. Amongst these are numerous large, somewhat flattened Echinids, *Clypeaster aegyptiacus*, Mich., which may be found on the surface, weathered-out, and in a remarkable state of preservation. One day I rode a dozen miles to the westward to Gebel Dixon, at the foot of which is an extensive "petrified forest," said to have been discovered by my kinsman, Mr. Waynman Dixon, civil engineer and Egyptologist; at any rate, it would appear that he first brought it to notice. I do not happen to have come across any explanation of these "petrified forests." The general appearance is that of a wood which had been destroyed by fire—the only remains being an accumulation of trunks and branches lying on the surface fully exposed. This exposure I take to be the result of sub-aerial denudation. The blowing sand has, by attrition, disintegrated all softer material which has been removed by the wind, leaving behind the hard silicified wood as we see it to-day. There is plenty of evidence in the desert of the power of blowing sand to effect such a work.

On my way back from Gebel Dixon three Gazelles galloped across the track—a beautiful sight; they appeared to me darker in colour than the animals that I had seen on the Libyan Desert, and my dragoman, Hajji Alî Gâbri, himself a child of the desert, or at least a Badâwîn, assured me that they were not the common Gazelle, and that it was a very unusual circumstance to see them so near to Cairo.[1]

At the foot of Gebel Dixon, at least ten miles from any water, I saw a big Dragon-fly (*Anax* sp.); I have often seen dragon-flies far from water, but never so far as on this occasion.

Near Gebel Dixon, and in other places on the desert, some search was made for the probable food-plant of *Helix desertorum*, Forst., the

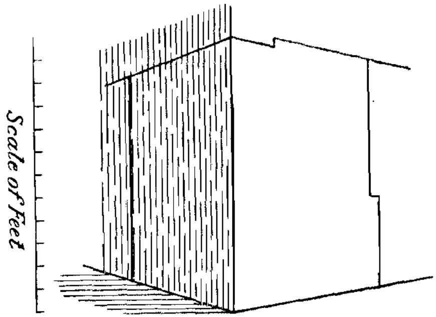


FIG. 15.—Jointing of Granite.

common Snail of those parts. It has been stated that these Molluscs, unlike their congeners, live upon a species of *Alga* that grows in dew-drops. All I can say is that I never found a living animal sealed up (as they all were) but what a careful search would reveal some traces of larger vegetation, such as dead stalks, within a very few yards. It is well known that these animals can live for several years without food, and I expect that it is quite common for them to remain thus sealed up for months, or even a year or more, until such time as rain restores the desert flora to its fitful life.

Absolutely devoid of ornament, the simple majesty of the Granite Temple, or Temple of the Sphinx, inspires a feeling akin to awe.

[1] Mr. Pocock informs me that in all probability these animals were Dorcas Gazelles (*Gazella dorcas*), a species of which many local races have been described.

One of the huge blocks of granite measured roughly 12 ft. by 7 ft. by 5 ft. The size of these blocks is in itself wonderful, but yet more wonderful the skill with which the fine joints and smooth surfaces have been wrought. The curious shape of many of the blocks adds another marvel. On the right-hand side of the diagram (Fig. 15) will be seen two "sets-off" each of about six inches. Why was this done? Was it to secure a special locking-bond, such as engineers use in lighthouse towers? Or was it to save costly material by the expense of cheap labour? Remember that those granite blocks had been transported by land and water close upon 600 miles. Or lastly, was it a mere *tour de force?* Similar sets-off may be seen in other parts of the building.

But the Granite Temple has yet another story to tell, to which my attention was drawn by Mr. Newton, of Mena. It has suffered severely from an earthquake—probably the same as that which so seriously damaged the King's Chamber in the Great Pyramid. An examination of the massive granite pillars, and especially the lintels (or stone beams) in the light of my Jamaican experience convinced me that the shock had come from the north or north-east. The crushing at the joints had been confined to the north side.

The Temple of the Third Pyramid, that of Mykerinos, has been excavated recently, and many stone hammers were found as well as granite blocks placed in position but in various stages of dressing. These give some idea of the immense labour involved in such work. Just inside the entrance was found a stone bearing an inscription to this effect: "This is the Temple of the deified King Mykerinos. and must not be used as a stone quarry."

CHAPTER IX

AUSTRALASIA, 1910

As when we were still some distance off the land numerous Seals had come out to bid us welcome to Cape Town, so when we left, the Mollymauks saw us off, handing over the R.M.S. "Arawa" to the charge of the numerous Petrels and stately Albatrosses, which were to conduct her personally across the Southern Ocean. Soon after losing sight of Africa we crossed the Mozambique current which brings warm water from the shores of Madagascar and Zanzibar down the eastern coast of Africa. The temperature of the water, which the Captain told me had been 60° Fahr. at 4 a.m., rose by breakfast time to 72°, but the south-west breeze coming up from the Antarctic was as low as 57°, though it was midsummer, and as a consequence the ship was wrapped in fog. The fog, however, in no wise disconcerted the Whales, which rolled and spouted in the warm water. Ten days later the temperature of the sea fell to 39° Fahr.—midsummer, mind you!—but possibly that meant that ice was not far off. Although the "roaring forties" treated us exceptionally well, roaring for but one day and night, the voyage from the Cape to Hobart was cold, cheerless, and tedious. We saw neither land, nor ship, nor even an iceberg, and one wearied of watching the quite mysterious flight of the Albatrosses. Those grand birds seemed simply to will, and then to glide in an inexplicable manner without the least exertion. The moving ship was to them as a motionless log, and, calm or storm, it seemed no trouble to overtake her, if by chance they had lagged behind to catch a fish or to squabble over some refuse cast overboard by the ship's cooks.

HOBART, TASMANIA, lat. 43° S.

January 20th, 1910.

As we steamed along the Tasmanian Coast, when about 5 miles off South East Cape, the nearest land to windward being 23 miles off, I caught on the ship a Muscid fly, *Pollenia stygia*, Fabr., and two or

three others were seen on board; the species is confined to Australasia. It was dark when we entered the fine harbour, and I was gratified to see the skill with which the ship's officers worked the signal lamps—a new accomplishment in the mercantile marine—the blinking light of a man-of-war at anchor being at once answered in the Morse code by our own. One of the junior officers presently brought me word that my son's ship, H.M.S. "Challenger," was at Wellington.

It was pleasant the next morning to land for a day ashore. We chartered a carriage for Mt. Wellington, though the cloud on its summit looked anything but promising. There is naturally great interest attaching to the capture of the first Butterfly in a new continent; accordingly on catching sight of one in a promising wild spot on the hillside some way above the town we called a halt. A fine golden-brown Satyr appeared to be not uncommon flying about quickly among tall bushes of a heath-like shrub, and from time to time settling upon the ground. They proved to be males of *Heteronympha merope*, Fabr., common to Tasmania and Australia. After many a chase four were secured; they yielded a faint scent of a sweet treacly character. The only other Lepidopterous insect was the large handsome Crambid, adorned with silver streaks, *Talis argyroneurus*, Zell., also peculiar to Australia and Tasmania, of which three specimens were taken. On the flowers of what I took to be a shrubby *Antennaria* were two Lycid beetles, *Porrostoma rufipennis*, Fabr., and *Calochromus scutellaris*, Erich., and a Lady-bird *Coccinella conformis*, Boisd., together with abundance of the small brown and black Chafers, *Phyllotocus rufipennis*, Boisd. We then pushed on to the Fern Tree Hotel, but meanwhile the clouds had come down to meet us, bringing rain of a hopeless character. The small Boarmiid, *Emmiltis rubraria*, Doubl., was kicked up, and searching the trunks of the gum-trees, while seeking shelter from the rain, yielded *Scoparia syntaracta*, Meyrk., *Scoparia gomphota*, Meyrk. (an insect of which the British Museum possesses but two specimens, from Tasmania), also a *Nudaria*-like moth, *Thallarcha* sp.; this was originally in fine condition, but the pill-box in which it was confined had been previously tenanted by a slug, and the little moth spoiled its wings with some of the slime left behind by the mollusc. This was the more unfortunate since it turned out that there was but a single worn individual (also from Tasmania) in the National Collection, and Sir George Hampson does not consider either specimen good enough to describe.

Of Beetles there was no great variety, but *Adelium abbreviatum*,

Boisd., was common under pieces of dead Eucalyptus wood, while in momentary glimpses of sunshine numbers of the velvety-black, red-tailed Lycid, *Metriorrhynchus haemorrhoidalis*, C. Waterhouse, flew slowly about bushy small-flowered Composites. The common Earwig, *Forficula auricularia*, Linn., also turned up, presumably an introduced species.

The only Molluscs that Mrs. Longstaff met with were introduced Slugs, viz. *Limax maximus*, Linn., and *Agriolimax agrestis*, Linn.

After we had refreshed the inner man there was nothing left for it but to descend. We found the town bathed in sunshine and paid a short visit to the Botanical Garden. Here I saw fresh specimens of the southern form of *Pyrameis cardui*, Linn., named by McCoy, *kershawi*, after Mr. Kershaw of Sydney, N.S.W. It oriented as I had seen the typical form do in many remote places. *Precis velleda*, Fabr., looked quite familiar, though I had never seen that species alive before : it was rather common but much worn and of extremely "dry" type. The only other butterfly was the widely spread *Zizera labradus*, Godart, a very uninteresting Blue, none the more attractive for being in poor condition. Out of a pine-tree I beat the Lithosiid *Scoliacma orthotoma*, Meyrk., it has a curiously truncated hind-wing.

The Ant *Camponotus novae-hollandiae*, Mayr, was very busy on the paths, and some as yet undetermined Acridians were to be found upon the lawns. There were several links with the Old Country; the Honey-bee, *Apis mellifica*, Linn., var. *unicolor*, Latr., and *Eristalis tenax*, Linn.; while Mrs. Longstaff found two living specimens and many dead spires of our common garden Snail, *Helix aspersa*, Müll., var. *undulata*, Moq. Tand.

From Hobart to Wellington the sea was unusually benevolent to us, drizzly weather, however, for three days made observations impossible; on the fourth a more broken sky allowed a noon-tide "sight," which proved us to be about 25 miles south of our reckoning. In really bad weather this might have been awkward since the lights on the Western Coast of the South Island are few and none too good. In the afternoon we sighted far, far away the New Zealand Alps, but could not make out any snow.

The next day we steamed up the fine harbour of Wellington, a harbour whose main fault is that though completely land-locked, it is too large to afford much shelter from an easterly wind. When we got alongside we were greeted by a not too clean Naval Lieutenant, who had come away from his ship in the midst of coaling. Grimy

though he was, he was none the less welcome, for had we not journeyed from the top of the world round to the bottom in order to see him?

EIGHT WEEKS IN NEW ZEALAND.

WELLINGTON (NORTH ISLAND), lat. 41° 15′ S.

January 20th, 1910.

It is difficult for any one who has read Commander J. J. Walker's "Antipodean Field Notes"[1] to make any general remarks about New Zealand, for that observant traveller's account of the aspect of the country is quite excellent. Indeed, my only excuse for writing at all is that he says nothing about the moths that he came across.

Wellington gave me the impression of solid prosperity and active business life. This impression is enhanced by the necessities of its situation, for the business quarter of the city lies along the foot of lofty hills, the main streets being laid out on land reclaimed from the harbour, hence the chief traffic is compressed within narrow limits, while the inhabitants live scattered over the steep hillsides. The suburbs are made readily accessible by electric tramways, which scale the hills in all directions. The author of "New Zealand Moths and Butterflies" lives at about the highest point, commanding a grand view over the lake-like harbour. We were fortunate in the occasions of our short visits, for we found "Windy Wellington" quite calm and peaceful, and suffered from neither gales nor earthquakes.

On my first visit I had an afternoon's collecting in the Botanical Garden. A part of this is cultivated, but a considerable portion consists of a hill covered with the Manuka, or Tea-tree (*Leptospermum scoparium*, Forst.), a gregarious plant highly characteristic of Australasia. From 6 feet to 20 feet high, often covering immense tracts of country, it has somewhat the appearance of a large Heath, but belongs to the Natural Order *Myrtaceae*. Its pretty little white flowers were nearly over at the time of my visit. Manuka bush is usually the resort of *Crambi*; here the species were **C. ramosellus*, Zell.,[2] and the abundant, but pretty, **C. flexuosellus*, Walk. Upon the paths, in the wilder and less frequented parts of the garden, two small species

[1] *Entomologist's Monthly Magazine*, Second Series, vol. xv., 1904, p. 24.

[2] To give an idea of the singularity of the New Zealand fauna, but at the same time to avoid repetition, I have in this chapter marked with a * species such as, to the best of my knowledge and belief, are confined to New Zealand.

of Tiger-beetle besported themselves, **Cicindela tuberculata*, Fabr., and **C. parryi*, White. Concerning the latter I have the following note: "On the ground; easier to catch than the British species; does not fly so readily; somewhat cryptic," which quite bears out Commander Walker's remarks (*loc. cit.*, p. 152).

But on that afternoon most of the insects in the garden seemed to be holding high festival at the blooms of a native shrub, the White Rata (**Metrosideros scandens*, Sol.). Here I secured several females of the pretty little **Chrysophanus sallustius*, Fabr., one of the commonest of the few indigenous New Zealand butterflies, which, in general appearance, is much more suggestive of *Nemeobius lucina*, Linn., than of an English Copper.

At the same flowers were a number of the black and white day-flying moth, **Deilemera annulata*, Boisd.[1] This, the first moth that I saw in New Zealand, soon became an even more familiar friend than the little butterfly. It is interesting in several respects. In the first place, it is peculiar to New Zealand; then it is the only representative of the Hypsids in those islands, though a closely allied, but abundantly distinct species, occurs in Australia. Black, with sharply defined white markings and a yellow body, it looks the very picture of a distasteful species. Its flight is slow, flapping its wings like a butterfly, for which it is usually mistaken by the uninitiated. It is distinctly hard to kill; when pinched it exudes a yellow juice, which is tasteless; but I did not detect any definite scent. Formerly its larva fed on various native species of *Senecio*, but since the introduction and wide-spread growth of Ragwort it has attached itself to that plant, on which both larva and imago are common enough. There is every reason to expect that it will increase in abundance, and certainly no one will grudge it its food.

On the same Rata bush I took the most conspicuous of New Zealand butterflies, **Pyrameis gonerilla*, Fabr., a handsome insect closely allied to our Red Admiral, more beautiful perhaps in colour, but scarcely as graceful in its flight. *Bombus hortorum*, Linn., a recent introduction, reminded me of home, as did the familiar flies, *Eristalis tenax*, *Calliphora erythrocephala*, Meig., and *Lucilia* sp.; but another common fly, *Pollenia stygia*, is confined to Australasia. Two immature Stick-insects (*Phasmidae*) complete the list of visitors to the white flowers of the Rata that afternoon.

[1] The generic name *Nyctemera* is now confined to a few large species from Africa, placed among the Lymantriids.

Napier (North Island), lat. 39° 31′ S.

January 28th, 1910.

From Wellington we went to Auckland by sea, and as the steamer called at Napier, we got an afternoon's collecting there. Acting on the advice of Mr. A. Hamilton, of the Dominion Museum, we made for a place where he told me that *Pyrameis itea*, Fabr., occurred, viz. a footpath from the Shakespear Road up the back of the Bluff. It was a steep track above a quarry, bordered on either hand by abundance of flowers, Red Valerian (*Centranthus ruber*) among them. One might have been climbing a chalk down in Surrey or Sussex. The abundance of a dark-flowered Scabious (*Scabiosa atropurpurea*), which had doubtless escaped from some neighbouring garden, helped to dispel the illusion, yet **Mnesictena flavidalis*, Doubl., a small, dark specimen, might perhaps have passed for an English Pyrale, or *Emmiltis rubraria* for an English *Acidalia*, but the Lycaenids fell far short of the beauty of our Chalk-hill Blue, or even our Common Blue. **Chrysophanus sallustius* was fairly abundant, but the dingy *Zizera labradus*, Godart (the *Lycaena phoebe*, Murray, of Mr. Hudson's book), was to be had in still larger numbers. I saw three or four **Pyrameis gonerilla*, Fabr., but not a sign of *P. itea*. A solitary **Deilemera annulata* put in an appearance. The pretty, day-flying Acronyctid, well-named *Cosmodes elegans*, Don., a species that is commoner in Australia, greatly delighted me; it is neatly marked with green and white. The only example of the cosmopolitan *Plusia chalcites*, Esp., that I have ever happened upon was, unfortunately, so worn as to have lost all its beauty; it might easily have been mistaken for *gamma*. Mrs. Longstaff found at rest upon a stone a very cryptic Geometer, *Phrissogonus laticostatus*, Walk. The vulgar *Eristalis tenax* and an active Homopteron completed my bag.

Mrs. Longstaff could find no Mollusca save *Helix aspersa*, the type and the variety *fasciata*, Pic.

Two moths came to the lights of the "Mokoia" as she was lying at the wharf—**Crambus flexuosellus* and **Elhamma* (*Porina*) *cervinata*, Walk.

Gisborne (North Island), lat. 38° 35′ S.

January 29th, 1910.

The ship reached Gisborne early, and I took a short stroll, from 8.0 a.m. to 9.30 a.m., along the shore at the foot of the bluff to the north of the town.

Almost my first remark (to myself) was, "Well, the Scotsman has brought his thistle with him to the Antipodes." On going closer to the plant I saw some insects on its flowers. Lo! *Bombus hortorum* and *Eristalis tenax*. More than this, under every stone and bit of drift-wood above high-water mark was abundance of our garden Snail, *Helix aspersa*. It seemed scarcely worth while to have travelled so far.

The only butterfly on the move at that early hour was *Zizera labradus*, the only moths single examples of **Deilemera annulata*, **Mnesictena flavidalis*, and **Crambus sublicellus*, Zell., together with several *Emmiltis rubraria*.

The vulgar-looking Fly **Sarcophaga impatiens*, Hutton (*nec* Walk.), is perhaps not as common as it looks.

Under flotsam and jetsam were plenty of the Earwig, *Anisolabis littorea*, White, for the most part immature. A solitary example had been taken at Napier, at least 100 ft. above the sea-level. A Cock-roach, **Platyzosteria novae-zealandiae*, Brunn., had but a moderate odour, which was evanescent.

Under dead wood, etc., I also found the introduced Slugs, one *Limax maximus* and many *Agriolimax agrestis*, as well as several *Vitrea cellaria*, Müll., f. *sydneyensis*, Cox.

AUCKLAND (NORTH ISLAND), lat. 36° 50′ S.

January 30th—February 6th, 1910.

Like Wellington, this is a finely situated and a busy town, but, unlike Wellington, its traffic is not forced into a few streets, the city being spread out over a number of low hills, hence it does not strike one as such a bustling place. Here I saw the one building in the Dominion that struck me as really admirable. St. Matthew's Church stands high and has a fine square tower; it is built throughout of the famous white Oamaru limestone, which has a remarkably fine effect, especially in the interior, looking like white marble. Its style is Perpendicular, both simple and dignified; I thought it by far the finest building in the Dominion. There is an admirable ecclesiastical custom in New Zealand. In many of the churches there are women in the choirs, but these women are all dressed alike, wearing college caps, broad white Eton collars, and either surplices or black gowns reaching to the feet. The dress is becoming, but effectually excludes feminine rivalry. I saw six women so dressed in one church, twenty-one in another.

During our stay in Auckland the heat was almost tropical, and I

was sorry that my "whites" had been left at Wellington; nevertheless there was no corresponding tropical abundance or variety of insect life, though it must be admitted that only twice did I get outside the cultivated area.

In the hotel a few very common insects turned up, some of them at any rate attracted by the lights: **Crambus flexuosellus*, *Plutella maculipennis*, Curt., *Borkhausenia pseudo-spretella*, Stain., and the Muscid fly, *Pollenia stygia*. There was, in addition to these, the Geometer, *Xanthorrhoë venipunctata*, Walk., which Mr. Prout tells me is scarce.

The Domain is a large park, comprising open grass-land, a cricket ground, an embryonic Botanical Garden, as well as a portion of the indigenous "bush." It is a pity that here, as elsewhere in New Zealand, it has been the practice to plant Australian gum-trees, Californian pines, or English oaks, to the exclusion of the trees native to the island, and the Domain, in common with other open spaces, has suffered from this, a fashion from which I have some reason to believe that New Zealanders are beginning to shake themselves free.

The insect in the Domain that most thrust itself into notice was the small moth-like Cicada, *Scolypopa australis*, Walk., which was extremely abundant on bushes, and on the bloom of Chinese Privet. On an oak-trunk I found a pupa-case of a much larger Cicada, also the Noctuid moth **Morrisonia insignis*, Walk. The only other moth found in this disappointing locality was the very common *Emmiltis rubraria*, which was kicked up. Sweeping yielded some fetid Bugs, *Rhopalomorpha obscura*, White, and *Tholosanus* sp., and any number of the Fly **Sarcophaga impatiens*. The Domain did not produce a single butterfly.

Mount Eden is interesting as a well-preserved volcanic crater, commanding an extensive view which embraces many other extinct craters; moreover, the municipal authorities have done well to secure it as a public park, but if the horticulture of the Garden of Eden did not attempt anything beyond a grove of *Pinus insignis*, I can only say that it has been much over-rated. The very insects also seem to have a poor opinion of the place, since I got nothing beyond several **Crambus sublicellus* and two or three Earwigs.

One-tree Hill is another volcanic cone planted with *Pinus insignis*. It produced **Deilemera annulata*, **Mnesictena flavidalis*, and abundance of **Sarcophaga impatiens*, while a number of Dragon-flies that were exceedingly hard to catch haunted its crest.

One day we landed at Takuna Point, near Devonport, to look for

marine shells, a search that met with but indifferent success as the tide was too high.

Zizera labradus was there to be seen in some numbers. I took one Geometer, *Anachloris subochraria*, Doubl., and might have taken more; it is an Australasian species. A Sphegid, *Tachysphex depressus*, Sauss., was not uncommon, making short flights close to the bare dried mud of a salt marsh.

Cemetery Gully, a gorge near the middle of the town, which Commander Walker found somewhat prolific, yielded me only a pair of Plumes, *Alucita monospilalis*, Walk., and a male *Tortrix postvittana*, Walk., an Australasian species.

Kauri Gully is so called because a few survivors of the magnificent native Pine of New Zealand, **Agathis australis*, Salisb., are there preserved in a patch of bush, traversed by a stream fringed with fine Tree-ferns; the bush is surrounded by a considerable extent of Manuka scrub. This gully was the most promising locality that I had visited, but it produced very little. The tiny Cicada, *Scolypopa australis*, was common enough; it was fond of settling on the stalks of the fronds of tree-ferns, often several in a row, usually head downwards. The sole Lepidopteron met with was *Chilo halterellus*, Zell., a handsome silver-striped moth, which occurs also in Australia. On sandy paths among the Manuka there were lots of **Cicindela tuberculata*, but the little beetles were not easy to see; with them were a couple of *Tachysphex depressus*. Under some logs near the school-house were plenty of a peculiarly ill-smelling Cockroach, **Platyzosteria novae-zealandiae*, and some Crickets.

Hot, muddy, and somewhat dejected by my poor success, I made for a cottage where home-brewed hop beer was to be had; roughly rolling up my umbrella net, I took my seat under the verandah and called for my drink. When the woman came back with the bottle, she eyed me suspiciously, and said, "I see you are an umbrella mender." Trying my best to conceal the wound inflicted by this thoughtless remark, I unrolled my net, saying, "Well, no, I am not exactly that; you see what sort of an umbrella mine is." But I was not to be let off; she replied, "If you want to catch flies, you had better go into the village." From that day I have been a humbler man.

Rangitoto is the name of an extinct volcano forming an island at the entrance of the harbour. It is covered from base to summit with huge blocks of the roughest of lava, which in turn are imperfectly covered with a scant shrubby vegetation. Its insular position and natural ruggedness have preserved the mountain in its wild condition.

A native shrub, *Veronica salicifolia*, Forst., was conspicuous by its long racemes of white flowers which were very attractive to the little golden brown **Chrysophanus sallustius*; the specimens I took were all females. On the way up—fortunately there is a path—I came across a few Geometers, **Epirrhoë deltoidata*, Walk., a very variable species, and the delicate little *Asthena pulchraria*, Guen., which unfortunately soon loses its pale green colour; in distribution it is Australasian. At and near the summit *Noctuae* were flying wildly about, but were by no means easy to catch, especially on such a terrain. One proved to be *Cirphis unipuncta*, Haw., an insect which seems to occur in every continent except Africa; two others were the cosmopolitan *Chloridea obsoleta*, Fabr. (formerly *Heliothis armiger*, Hübn.); one of them, caught at the bottom of the old crater, was of the grey form, such as occurs in Europe, far less brilliant than most Southern specimens. On reaching the lip of the crater I disturbed a Vanessid; a lucky swoop over my head secured it at the first shot; to my great delight it proved to be *Pyrameis itea*, a male in fine condition, the only one of the species that I came across in New Zealand. It is interesting to note that Commander Walker's only specimens were taken on the top of Mt. Eden, so that it would appear to be, like the Painted Lady, a haunter of hill-tops. The crest of the mountain did not strike me as a likely place to find a delicate Demoiselle Dragon-fly, but there I took **Lestes colensonis*, White. Under the bark of a dead tree about halfway up I found **Platyzosteria novae-zealandiae* and two specimens of a *Temnopteryx*, which Mr. Shelford thinks may be new.

Rangitoto is the most perfectly preserved extinct volcano that I have ascended, its crater being unusually well preserved. Though just under 1000 ft. in height, it commands a glorious view extending over Waitemata Harbour, with all its bays and creeks dotted over with islands far and near, one of them near the N.W. horizon being Great Barrier Island, now kept as a sanctuary for native animals and birds. On the other side lies Auckland and the many cones that rise in or around the city.

In the bush on Rangitoto Mrs. Longstaff found a specimen of the Hedgehog-slug, *Arion intermedius* (*minimus*), Normand,—a singularly isolated spot in which to find an introduced Mollusc. Higher up I came across *Vitrea sydneyensis*. On the shore Mrs. Longstaff found dead spires of **Turritella fulminata*, Hutton, and *T. vittata*, Hutton.

I must not quit Auckland without mention of its fine museum, with its well-arranged collection of Maori antiquities and its courteous

and accomplished curator, Mr. T. F. Cheeseman, F.L.S., to whom we are much indebted.

We made a special expedition to Shoals Bay on the side of the harbour opposite the city in search of *Amphibola crenata*, Martin, an air-breathing operculate Gasteropod which lives in brackish water half-buried in the mud. This is a remarkable animal in that having a pulmonary chamber and no gills it would appear to be in a transitional state from a water-dweller to a land-dweller. We found it in considerable abundance in the mud in a Mangrove swamp not far above low-water mark. In the same place we picked up a few dead spires of *Turritella rosea*, Quoy.

At NGARUAWAHIA, about halfway between Auckland and Rotorua, on February 8th, a pretty and very distinct Noctuid flew into the train. This turned out to be new to science, and has been described by Sir George F. Hampson under the name of **Morrisonia chlorodonta, sp. nov.*[1] [See Plate VI., Fig. 2.]

On the higher land we saw from the train something of the peculiar vegetation of New Zealand, the so-called Cabbage-tree, *Cordyline australis*, Hook.; the Bulrush, *Typha angustifolia*, Linn., and vast extents of Manuka, now somewhat sombre, but beautiful when in flower.

ROTORUA (OHINEMUTU), NORTH ISLAND, lat. 38° 5′ S.

February 9th—16th, 1910.

I must admit to a strong feeling of disappointment in the Hot Lakes. How far this is due to having heard too much about them, and therefore expecting too much; how far to the destruction wrought by the great eruption of Tarawera in 1886; how far to the fact that I lacked time and energy to see some of the more inaccessible sights, I know not, but the impression remains. Volcanic phenomena are not in their nature beautiful, but the reverse. Interfering with, or even putting a stop to, vegetable and animal life, they disfigure the landscape with blains and scars. The interest in such phenomena is scientific, not aesthetic.

We stayed at Whakarewarewa,[2] about two miles south of the railway station and in the very midst of the hot springs and geysers. Most persons dislike the sulphurous atmosphere, but to the writer it

[1] *Ann. Mag. Nat. Hist.* (8), viii., pp. 423, 424 (1911).

[2] It will surprise no one to be told that this formidable Maori name is usually abbreviated to Whaka. Where in this part of my narrative no locality is mentioned, the sesquipedalian name is to be assumed.

recalled pleasant bygone days spent in the Glastonbury Kitchen at Oxford. It was strange in the quiet of the night to listen to the bubbling of sulphuretted hydrogen in mud volcanoes not a hundred yards away!

To see Pohoto, one of the principal geysers, in full eruption is a sight well worth waiting for. The Government caretaker has a fairly accurate idea of the hour when the almost daily eruption may be expected, and to watch the uncanny fountain for half an hour or so while it is getting up steam is quite fascinating. The caldron, perhaps 20 feet across, holds crystal-clear hot water of a delicate pale blue tint always on the simmer. Every few minutes it boils up more fiercely; the successive bubblings-up increase in violence and amplitude; every now and again the water rises higher than before, as the temper of the demon of the springs waxes worse and worse, till the watcher gets into a state of tension in which impatience and fear struggle for the mastery. Several outbursts look promising, but prove illusory, but at last, with a mighty roar and with an alarming throbbing of the ground beneath one's feet, the boiling water rushes up into the air some 80 feet or so. The grand display may last half an hour, or it may be an hour, or even two. While the main fountain shoots up boiling water and steam, other subsidiary fountains round about are also active, but I observed that they did not keep time with Pohoto.

That the phenomenon is due to the water coming in contact with rocks of a temperature above the boiling point, or else with superheated steam, or both, is fairly certain, but it is most difficult to think out the details of the *modus operandi.* These geysers cover a large extent of country in the North Island; from time to time one or another ceases to work, perhaps to resume its activity after months or years of quietude.

Once a tourist watching the geyser in a time of repose thoughtlessly threw a stick into it; his retriever bounded forward. There was no time to stop him; he plunged into the nearly boiling water and met with a speedy death.

I asked our Maori lady-guide whether accidents often occurred, but she assured me they did not. I expressed some surprise that with so many Maori children playing close around the springs none ever fell in and were boiled. "Oh yes! of course they do; but native children don't count. Never any tourists." The Maori women, as is well known, unlike those of most other savage races, are not without attractions, but it is to be feared that they are somewhat hard-hearted towards their offspring.

Whether it be the sulphurous fumes, the barren nature of the soil, the climate, or the combination of the three, I know not, but the Hot Lakes district has an evil repute as a collecting ground, and certainly my experience goes to confirm that of the New Zealand entomologists. On the whole the hotel itself was the most productive spot; this is said in no bad sense as implying any undue abundance or variety of species predaceous on man, but refers to the harmless frequenters of the electric lights.

The commonest Noctua was unquestionably *Persectania ewingi*, Westw. (*Melanchra composita*, Guen., of Mr. Hudson's book),[1] of which I took fourteen; **Morrisonia mutans*, Walk., which used to turn up later in the evenings, came second in numbers; **Hyssia moderata*, Walk., was a good third, with eight specimens; **Euxoa admirationis*, Guen. (*sericea*, Butl.), running it close with seven. Of the delicate *Cosmodes elegans*, I was fortunate in securing four, but it does not appear to be easy to get this insect in good condition; Mr. A. Hamilton does not look upon it as a common insect; its general colour is reddish-brown with bright emerald-green markings neatly outlined with white, but it looks very pale when on the wing. Another Australasian[2] species, *Agrotis compta*, Walk. (*Orthosia immunis*, Walk., of Mr. Hudson's book), is very variable, one of my specimens being unicolorous purplish grey. Of the glossy purple-brown **Bityla defigurata*, Walk., a single example turned up. Of two *Chloridea obsoleta* which came to the lights, one straightway betook itself to a double White Dahlia which stood in a flower vase; like too many a tourist, its first idea on reaching its destination was to have a drink. This thirsty soul was orange-tinted, approaching Walker's var. *rubescens*, but not quite attaining the full glory of many Australian specimens, which have the fore-wings pink.

Besides these more or less well-known things there came no fewer than nine specimens of a pale, silvery-grey moth which appears to be undescribed. I have represented it in Plate VI., Fig. 1.[3] To these should be added the Deltoid, **Rhapsa scotosialis*, Walk.

The Geometers visiting the lights were not so numerous: the grey **Coremia semisignata*, Walk.; the yellow *Anachloris subochraria*; *Phrissogonus laticostatus*, and the neatly marked Pug, *Microdes quadristrigata*, Walk.

[1] "New Zealand Moths and Butterflies," G. V. Hudson, F.E.S., 1898.

[2] I apply the term "Australasian" to species which occur in Australia, Tasmania, and New Zealand, but not elsewhere.

[3] Since described by Mr. G. W. Howes (*Trans. New Zealand Inst.*, 1911), under the name of *Morrisonia sequens*, sp. nov.

There were several Pyrales: **Mnesictena flavidalis;* the variable **Scoparia submarginalis,* Walk., several; **S. indistinctalis,* Walk.; *S. leptalea,* Meyrk.; **S. philerga,* Meyrk.; the Hydrocampid, *Nymphula nitens,* Butl., (2); the Phycid, *Homoeosoma vagellum,* Zell., (2); the handsome silver-striped *Chilo halterellus;* **Crambus angustipennis,* Zell.; **C. sublicellus.* By far the fussiest and noisiest visitors were two large brown Longicorn beetles, **Ochrocydus huttoni,* Pascoe, which is considered a good thing.

Quite a number of Tortrices came to light: one **Tortrix leucaniana,* Walk., a male; **T. excessana,* Walk., one of each sex, and several *T. post-vittana,* Walk., mostly females. The last-named, Mr. Durrant says, is an Australian species which has spread to New Zealand, to the Sandwich Islands, and other places. This was also taken in the hotel garden on the wing at dusk accompanied by *Ctenopseustis obliquana,* Walk., another species that is spreading widely, and the cosmopolitan Hemerophilid, *Porpe bjerkandrella,* Thunb.

The domesticated *Borkhausenia pseudo-spretella,* Stain., and several Blow-flies, *Pollenia stygia,* were inmates of the hotel.

In the small garden I took **Crambus apicellus,* Zell.; the Humble-Bee, *Bombus harrisellus,* Kirby; two small Bees, *Paracolletes vestitus,* Smith, and the Asilid fly, **Saropogon fugiens,* Hutton.

The Geyser Reserve at Whakarewarewa and the Public Gardens at Rotorua were alike singularly barren of insect life. Dragon-flies were the most prominent objects, especially Demoiselles, **Lestes colensonis,* being especially common near the lake. The Manuka bushes gave shelter to **Crambus flexuosellus,* odd specimens of **Scoparia eucarpa,* Meyrk., and **Sestra flexata,*[1] Walk.; a brace of *Asthena pulchraria,* and sundry Bugs, **Nysius zealandicus,* Dall., while **Cicindela tuberculata* ran or flew about the paths. The sole butterfly was *Zizera labradus.*

Excursions to various points on the shores of Lakes Roto Rua and Roto Iti did not yield much more. The little uninteresting *Zizera labradus* was generally abundant, showing a partiality to Vervain (*Verbena officinalis,* Linn.), an introduced plant. This reminds me that in moist meadows *Bartsia viscosa,* Linn., another introduced plant, grows in the greatest abundance, though in England it is quite local. Again, the introduced Bramble, in spite of being scheduled by Act of Parliament as a "noxious weed," was growing luxuriantly in and around the Maori village of Te Awahou, and

[1] Mr. Hudson, by some accident, has reversed *flexata* and *humeraria,* but I have examined both the types in the British Museum, and compared them with Walker's descriptions, so that there is no doubt about the matter.

producing fruit the like of which as regards abundance, size, and flavour I have not seen approached in the old country. "But ne'er the rose without the thorn." And if you *should* put into your mouth a certain small Hemipteron that is too apt to lurk among the luscious drupes, well, you will rue the day. Yet another English plant, the familiar Ragwort, harboured—not the Cinnabar—but both larvae and imagines of **Deilemera annulata*, as well as abundance of the Bug, **Nysius zealandicus*. With the common *Emmiltis rubraria*, a specimen of **Asthena rubropunctaria*, Doubl., was taken. Sweeping Manuka bushes resulted in the capture of the shiny green beetle, *Calonota festiva*, Fabr. The Asilid, **Neoitamus varius*, White, which I found by the exquisitely clear water of the cold spring at Hamurana, was a fly new to me, but *Bombus harrisellus* was familiar enough. It is not many years since *Bombus hortorum* was purposely introduced into New Zealand, and it is remarkable that the form *harrisellus*, which is comparatively scarce in England, is in New Zealand so common that my impression is that there was one of the melanic form to every two or three typical specimens. As in the old country, no intermediates were met with. Surely this is a case about which the Mendelians might have something to tell us.

In the clear stream that flows from the Hamurana Spring, Mrs. Longstaff found several Water Snails. The most abundant was **Potamopyrgus corolla*, Gould, both the smooth and the spiny forms; **Isidora novae-zealandiae*, Sowerby; *Amphipepla arguta*, Hudson, and *Sphaerium lenticulum*, Deshayes.

At Okere on Lake Roto Iti we were told that the quantities of shells of **Diplodon menziesi*, var. *hochstetteri*, Dunk., had been left there by the Maoris, who dredge the bivalves out of the lake for food; the valves are some 2½ inches long.

On the top of a small mountain, Pohaturoa, which overlooks the Geysers, I took three males of the Southern form of *Pyrameis cardui*, known as *P. kershawi*. This is distinguished from the type by a row of blue spots on the hind-wings, but in the absence of other distinctions this scarcely seems enough to raise it to specific rank. I am the more confident in this opinion since the Hope Collection contains two specimens with like blue spots, one from Cyprus, the other from Mongolia. Moreover, in the fine old Dale Collection there are three similar British examples. It is interesting to bear in mind that somewhat similar blue spots occur in many specimens of *Chrysophanus phlaeas*, and **C. sallustius*. On the same mountain I took a second specimen of the Asilid, **Neoitamus varius*.

One day I drove to the foot of Mt. Ngongotaha, not to the

summit, as did Commander Walker and Dr. Swale. The ascent is steep, but the track through the bush is quite wonderful; the ground is carpeted with ferns of many kinds, the trunks of the forest-trees are draped in climbing ferns, and a considerable proportion of the trees overhead are themselves ferns. I certainly thought that I had seen many ferns in Jamaica (amongst other places), but truly New Zealand is their head quarters. In this dense bush, which the sun could only pierce here and there with its rays, I saw remarkably few insects. The sole record that I have is that of the Geometer, **Pseudocoremia productata*, Walk. But as an entomologist I have long had a prejudice against ferns as cover for insects.

The summit is comparatively flat and the bush more open. Here I came across an old friend, **Griselinea littoralis*, Raoul, a bright yellow-stemmed evergreen shrub that I have grown at Mortehoe for many years. There I have often admired its marvellous power of resisting the onslaughts of the sea wind, a power that seems to be due to the flexibility of its twigs, which is such that they may almost be tied into knots. In the more open bush on the summit there was a good deal of the *Veronica salicifolia*, and, as on Rangitoto, its flowers proved to be attractive to insects, though here no Lepidoptera were found on them. There was, however, abundance of the little Bee, *Paracolletes vestitus;* a black Pompilid, *Salius monachus*, Smith; and three of those strange little Weevils, **Scolopterus penicillatus*, White, black fellows with sharp spikes on their elytra; if not absolutely indigestible, they must at least be as pungent as cayenne-pepper.[1]

It is curious that so very few things were to be found in such a promising-looking place; neither **Chrysophanus sallustius* nor **Deilemera amulata* were at all common. Though I saw no water on the mountain, there were the usual Demoiselles up to the very summit, 2550 ft. A Syrphid peculiar to the Dominion, * *Helophilus ineptus*, Walk; a *Saropogon* sp., ♂; and the Asilid, **Neiotamus varius*, complete my short list.

I descended by the more circuitous but more open carriage road, and, especially about halfway down, beat out a fair number of Geometers, of which a fraction was secured, comprising the greenish *Asthena pulchraria*, the pale grey **Coremia cineraria*, Doubl., and the variable **Epirrhoë deltoidata*. The Tutu (*Coriaria ruscifolia*, Linn.) was the shrub which appeared to be the shelter favoured by moths. Near some water at the foot of the mountain I saw the first *Zizera labradus* for that day.

[1] An allied species is figured on Plate VI., Figs. 6, 7.

Another day we drove by motor-car over the soft pumice roads to Wairoa by way of Okareka Lake and through the TIKITAPU BUSH. The latter would appear to have somewhat recovered from the dire effects of the eruption, and the chirruping of cicadas filled the air. Whether the fine green *Melampsalta muta*, Fabr., was the musician, as seems likely, I know not, but if it was, what in the world induced Fabricius to call it mute? I only succeeded in catching three, whereof one settled on the motor, another on my face. My wife found a Stick-insect on her dress. The chauffeur picked up on the road the large brown Cicada, *Melampsalta cingulata*, Fabr., which appeared to have recently died. The common New Zealand Tiger-beetle, **Cicindela tuberculata*, again put in an appearance.

Had it been Natal the grassy borders of the road would have been gay with butterflies, but as it was New Zealand I had to be content with a few specimens of a *Chrysophanus*, that I had not before met with—**feredayi*, Bates.[1] Here and there *Zizera labradus* turned up, but not in any numbers, and the only other butterfly seen that day was **Pyrameis gonerilla*, which occurred near Lake Okareka. Close by, on a bit of swampy ground covered with interesting vegetation, I captured two of the pretty little grey Geometer, *Adeixis inostentata*, Walk., which Mr. Prout says occurs also in Australia; no doubt I could have got more had not time pressed. In the same swamp sundry Dragon-flies and the Asilid, **Neoitamus varius*, were found.

In the bush sweeping the flowers of the *Veronica salicifolia*—on which most of the **C. feredayi* were taken—yielded the small Longicorn, *Naomorpha lineata*, Fabr., the little Bee, *Paracolletes vestitus*, and the spiky-backed Weevil, * *Scolopterus tetracanthus*, White [see Plate VI., Figs. 6, 7], insects that must be handled carefully; the Bugs, *Tholosanus proximus*, Dall., and *Cermatulus nasalis*, Westw., both extending to Australia and Tasmania.

The sole Geometer met with in Tikitapu was the now familiar **Coremia cineraria*. A crowd of Bugs, *Neuroctenus* sp., were found under the bark of logs, their flattened shape well suited to the narrow accommodation.

Mrs. Longstaff found quite a number of Land Shells in Tikitapu Bush, all small species, some minute and insignificant looking—as indeed are most of the Land Molluscs of New Zealand. They were chiefly found under the bark of logs, or on the shaggy trunks of fallen Tree-ferns. Several *Delos jeffreysiana*, Pfeiff., *Endodonta*

[1] Mr. Hudson calls this *enysii*, Butl.; I have, however, examined the types in the British Museum, the two are unquestionably conspecific, and Bates' name has priority.

(*Charopa*) *coma*, Gray; *E. anguiculus*, Reeve, also var. *montivaga*, Suter; *E. bianca*, Hutton, f. *montana*, Suter; *E. tapirina*, Hutton; *Thalassohelix ziczac*, Gould; *T. zealandiae*, Gray; the endemic Slug, **Janella bitentaculata*, Quoy, sub-sp. *rufovenosa*, Suter, and, here as everywhere else, the introduced *Agriolimax agrestis*.

At Wairoa **Epirrhoë deltoidata*, and *Anachloris subochraria* were to be had, but not many of them; here also the chauffeur caught a large fly **Hystricia lupina*, Svederer. Somewhere that day I took a second example of the *Saropogon* found on the top of Ngongotaha.

By the roadside above Lake Roto Kakahi was a little cliff of pumice sand about which flew numbers of *Gasteruption unguicularis*, Smith, a strange-looking and still more strangely named Evaniid Hymenopteron, of which the larva is said to be parasitic on other hymenopterous larvae. Close by I swept three pretty Tortrices off the Veronica: **Heliostibes illita*, Feld. & Rog., of which the National Collection possessed but one specimen; its hind-wings are black, marked and fringed with orange.

In the train between Rotorua and Taumaranui (at Otarohanga), I captured the Cicada, *Scolypopa australis*, and at a way-side station, Te Kuiti, found plenty of *Zizera labradus*, together with abundance of *Emmiltis rubraria*.

Taumaranui (North Island).

February 17th and 18th, 1910.

Many moths came to the humble hostel where we slept. Far the commonest of these was *Emmiltis rubraria*, which appeared in numbers; the fine **Hemerophila dejectaria*, Walk. (*pannularia*, Guen.), turned up here for the first time, as did two specimens of the smaller **Epyaxa subidaria*, Guen., while among the more ordinary things were **Coremia semisignata* and **Pseudo-coremia melinata*, Feld., with which I afterwards became very familiar. The Noctuae were represented by *Persectania ewingi*, **Morrisonia mutans*, **Euxoa admirationis*, Guen., also the tiny Plusiid, *Hypenodes exsularis*, Meyrk., which is only three-quarters of an inch in expanse, and might well pass for a Phycid. Then there were a fair number of Pyrales, including **Mecyna maorialis*, Feld., the spidery-legged *Scoliodes cordalis*, Doubl., and the fidgety *Diasemia grammalis*, Doubl., the last two being Australasian in distribution. There was also a **Tortrix leucaniana*, a female.

But better than all these was a second specimen of the new

**Morrisonia*, taken in the train at Ngaruawahia on February 8th. Most of the New Zealand Noctuids are extremely variable, and **M. chlorodonta* would appear to be no exception to the rule. Whereas in this specimen the base, the stigmata, the area just below the latter, and the subterminal line were all olive-green during life, the first specimen taken had the margins of the stigmata and the subterminal line white.

The next day I walked round the place, and passing the first pumice-stone quarry that I had ever come across went up on to the bluff that overlooks the little town. A worn *Chloridea obsoleta* was caught flying wildly in the sun. *Anachloris subochraria* recalled our Yellow Shell both in colour and ways, but was not common. I picked up a stray **Crambus sublicellus*. A small white-flowered tree, **Hoheria* sp., which reminded me of the Nova Scotian Snowy Mespilus (*Amelanchier* sp.), had attractive blossoms at which were both **Chrysophanus sallustii* and **feredayi*, together with a Bee and a pair of Flies, *Odontomyia chloris*, White, having the abdomen green at the sides and a paler green beneath, besides a number of the spiny, bronze-black Weevils, **Scolopterus penicillatus*. In the valley, between the bluff and the railway **Pyrameis gonerilla* was flying in some numbers about and around its food-plant, the formidable shrubby Nettle, **Urtica ferox*, Forst., on which plant I also took **Crambus flexuosellus*.

About the town the little *Acidalia*-like *Emmiltis rubraria* was everywhere to be seen; on every piece of rough grass between the houses and the river it simply swarmed; never do I remember to have seen any Geometer in such abundance. Though it came freely to light, it must be to some extent a day-flyer, since I saw it feeding in the afternoon sunshine on the flowers of Ragwort by the roadside, and on those of the Canadian Golden-rod (*Solidago* sp.) in gardens. As might have been expected **Deilemera annulata* was to be seen on the same flowers. I should not be surprised if this Golden-rod were to naturalize itself and add one more to the many statutory noxious weeds.

Some lush meadows by the river were so full of flowers, especially the introduced Musk (*Mimulus moschatus*), that I felt sure they must harbour many insects, but the fact did not bear out the forecast. Beyond the aforesaid Geometer, plenty of New Zealand's Common Blue, some Dragon-flies, **Lestes colensonis*, and a number of the familiar little Syrphid, *Melanostoma mellinum*, Linn.,[1] the land seemed to be singularly barren.

[1] This I should take to be an introduced species. Among my specimens was a

**Sarcophaga impatiens* turned up again at Taumaranui, and I had the good fortune to get at the same place a female of * *Tabanus impar*, Walk., of which the National Collection has but a solitary male, also from New Zealand. As Mr. Austen is making a special study of the genus I thought it best to mate this fly with that in the Natural History Museum.

THE WANGANUI RIVER.

The voyage down the Wanganui River from Taumaranui to the sea is one of the sights of the world. It *may* be done in two days, but it is far pleasanter to take three, as we did, staying the night at Ohura. During the first day's voyage the river, broken by a succession of rapids, winds from side to side of a comparatively open valley. The mountains on either hand running up to 2000 ft., or it may be higher, often expose on their flanks fine sections, some at any rate appearing to be of pumice, like that near Taumaranui station. Inhabitants are few and far between, the slopes being covered with seemingly trackless forests. Most of the trees are evergreen and sombre, albeit pines are few, but here and there rose a handsome flowering tree, though it was late in the year, since the Southern February corresponds to the Northern August, and flowers were for the most part over. A brighter tint of green is given to the lower parts of the bush by the numerous Tree-ferns of various species, some tall and slender, others short and robust; a common kind having the underside of the fronds a silvery white. It is most fortunate that the bush through which the Wanganui flows has hitherto remained almost unscathed by fire.

An afternoon at Ohura, where the house-boat, a floating hotel, is moored, should have provided good sport, so at least one felt justified in hoping, but once again the bush proved sadly disappointing. The dingy little *Zizera labradus* was indeed common enough, and I saw more than one * *Pyrameis gonerilla*, but no other butterflies. At the top of the cliff, in a small clearing, stood a solitary *Salix alba*, of course an introduced tree, but it had a very ancient appearance owing to the fact that it was clothed with indigenous ferns and other epiphytes. On its trunk were abundance of the pupa-cases of a large Cicada (? *Melampsalta cingulata*); the perfect insects sang loudly in the branches far above my head, but declined altogether to venture within reach of the net. It was a fascinating experience to

female, which Mr. Austen said he could not match with anything in the British Museum, but in the absence of a corresponding male he could say nothing further.

walk about in a large grove of lofty Tree-ferns, though it must be admitted that they are scarcely beautiful when seen from below on account of the untidy, ragged tangle of dead and dying fronds.

In more open parts **Uropetala carovei*, White, and other dragon-flies hawked about. Sweeping the Manuka produced a few *Calonota festiva*, but Commander Walker tells me that he once saw the branches of the Tea-trees actually bowed down by the weight of immense numbers of these shiny-green beetles.

That night a second specimen of the fine Boarmiid, **Hemerophila dejectaria*, came on to the house-boat.

At Ohura Mrs. Longstaff found several of the Slug *Agriolimax laevis*, Müll.; they were of a very dark brown colour, almost black.

Roused soon after dawn, we were given breakfast and started on our second day's voyage. The gorge was filled with white mist, the sun not having as yet penetrated its chill depths. It was a glorious sight to witness the victorious combat between the warming rays and the dank vapour. The greater part of our 60 miles' journey was through what in the Americas would be called a cañon, for the valley is contracted with steep craggy sides. Indeed for some hours we seemed to be imprisoned in a narrow dark gorge, the deep, clear swift stream gliding noiselessly between vertical walls of dark coloured rock clothed with filmy-ferns (*Hymenophyllum*), or moss, or such other vegetation as could find a roothold. Above the beetling crags hung the feathery Tree-ferns; above these in turn we saw now and again the mountain tops closing in the whole with a still more lofty rampart. Our prison walls might be anything from 20 feet to over 100 feet in height; often for a mile or more there was scarce standing room at the water's edge on either side, so that a sunken rock, or still more deadly snag might well have entailed a swim for dear life of half a mile or more. The beauty, the strangeness, and the solitude of the whole scene were quite awe-inspiring. Anon the walls would recede and the gorge open, this meant a rapid, after passing which another gorge would be entered. The only living creature was an occasional Cormorant that seemed indignant at our intrusion, but the roughest of ladders fixed in two or three places gave access to the bush above, and proved that sometimes at any rate the varied wants of man led him to go up or down those dark and slimy walls.

Doubtless the voyage has lost much of its romance since Maori canoes gave way to Thorneycroft steam-launches, but it must not be hastily assumed that increased safety always goes with increased comfort. The rapids are far too numerous and tortuous for any pilot

to get more than a very general knowledge of the dangers to be avoided, and consequently the launches bump frequently and heavily. I thought at the time that it was a great mistake to use steel-built craft on such a river. The most suitable boats would be double-straked wooden vessels, built as whaling ships are. The very next launch to ours struck a snag and sank just as she was being beached. Luckily it was a place where there was standing room, and what is more, the means of making a fire, so that beyond wet feet and skirts and soaked baggage, the sufferings of the passengers and crew were not serious. Two men made a raft, and went in the darkness seven miles down the river for help, for there was no telegraph, not even a road through the bush. After waiting some hours, another launch was sent up in the darkness to pick them up, and after doing so was itself twice within an ace of being wrecked, and that in a much more dangerous place, where the water was deep. The rescuing party had not the foresight to carry any food, so the forlorn passengers had but a cup of tea and two or three biscuits apiece between lunch one day and breakfast the following morning. Among them was a lady who a few weeks before had suffered a much more serious shipwreck in The Sounds, and, with her fellow-passengers, had been taken off a rock by H.M.S. "Pegasus." Such is holiday making in New Zealand!

PIPIRIKI, WANGANUI RIVER.

February 20th—22nd, 1910.

Pipiriki overlooks two of the more open reaches of the river where the rapids are perhaps at their worst.

Once again the hotel proved to be the best collecting ground. It is a large wooden building only just opened, replacing a previous structure that had been burned down a few months before.

Although **Deilemera annulata* was unusually abundant in the locality, I was surprised when several of them came to light; it was more in accordance with the fitness of things to welcome *Persectania ewingi*, **P. atristriga*, Walk., **Morrisonia insignis*, and even the cosmopolitan *Cirphis unipuncta*, Haw.

With the Noctuae came several Geometers: *Epyaxa subidaria*, **Selidosema panagrata*, Walk.; **Pseudo-coremia suavis*, Butl.; *Asthena pulchraria*, and *Emmiltis rubraria*, although this last was nothing like as common as at Taumaranui; by far the most conspicuous of the family was **Hemerophila dejectaria*, of which I got no less than eight.

Pyrales were also fairly numerous, the commonest being **Mecyna maorialis*, the restless little *Diasemia grammalis*, and the pretty *Sceliodes cordalis*, which rests in a peculiar attitude: standing like a gnat on the tips of its middle and hind tarsi, the costae of the fore-wings making an angle of about 100°; not only are the fore-wings somewhat drawn back, so as to cover the hind-wings, but the latter are drawn away from the abdomen, which in its turn is curled up on high. Other Pyrales that came singly were **Scoparia chalicodes*, Meyrk.; **S. periphanes*, Meyrk.; **S. minualis*, Meyrk., and **Crambus flexuosellus*, also **Tortrix leucaniana*. With these were several of the Swift, **Elhamma* (*Porina*) *signata*, Walk., some of them of the variety *novae-zealandiae*. Sundry other creatures, Beetles and Grasshoppers, and the Cockroach, **Platyzosteria novae-zealandiae* joined the merry party, together with a Fly, *Exaireta* sp., which is not in the National Collection.

On the top of a small hill, perhaps 600 ft. above the river, were two large plants of Ragwort in full flower, each of them harboured 36 **Deilemera annulata*. This moth was indeed to be seen everywhere at Pipiriki. Near the same spot I missed a very fine *Pyrameis kershawi*, that must have recently emerged, and not far away I came across **Chrysophanus sallustius*.

One afternoon we went a short distance down the river in a Maori canoe. Mrs. Longstaff found two species of fresh-water Shells in the river; **Potamopyrgus corolla*, which was literally in thousands, the spiny form greatly preponderating over the smooth; and the fresh-water Limpet, **Latia neritoides*, Gray, which was in plenty, adhering to conferva-covered stones. In the bush on the bank, perhaps a mile and a half below the hotel landing place, my wife found, under the bark of introduced Willow-trees, numerous examples of a tiny Snail, which Mr. H. Suter, of Auckland, considers to be a new sub-species of **Laoma celia*, Hutton, sub-sp. *laevis*, Suter. She also found the pretty *Flammulina crebriflammis*, Pfeiff.; *Therasia valeria*, Hutton, and *T. subincarnata*, Suter, and among dead leaves of Karaka (*Corynocarpus laevigatus*, Forst.), a specimen of the introduced Slug, *Milax gagates*, Drap., var. *ravus*, Williams, which differed from other specimens taken in New Zealand or elsewhere by its rich amber colour—much like the fruit of the tree under which it was found; the commoner var. *plumbea*, Moq.-Tand., of the same was found close by, together with the endemic **Janella rufovenosa*.

By sweeping rank herbage I got a few specimens of an Australasian Bug, *Tholosanus proximus*, as well as half a dozen of the very

singularly shaped little Weevils, **Rhadinosomus acuminatus*, Fabr., which have both head and thorax greatly elongated, the elytra terminating in a spine [Plate VI., Fig. 4]. As Mr. Arrow says, they look almost like "silver fish" (*Lepisma*); they vary considerably in size.

Under willow-bark I found sundry small Beetles not yet determined, but amongst them was a female of the Cockroach, *Temnopteryx* sp., first met with on Rangitoto.

Near the landing place I took *Cosmodes elegans* on the wing, but cannot be sure whether it was flying of its own accord, or had been disturbed.

On the high ground were found the Flies, **Saropogon clarkii*, Hutton, and **S. fugiens*, Hutton. The handsome big Syrphid, **Helophilus trilineatus*, Wied., flew into our bedroom, as did the large Dragon-fly, **Uropetala carovei*, which appeared to be common in the district.

Other insects found at Pipiriki were **Coremia semi-signata*, **Mnesictena flavidalis*, **Scoparia diphtheralis*, Walk.; the Fossor *Tachysphex depressus;* the Flies, *Eristalis tenax, Melanostoma mellinum*, and **Tabanus truncatus*, Walk., a male, as well as the common Tiger-beetle, **Cicindela tuberculata*.

It was at Pipiriki that I measured a fine frond of the Tree-fern *Cyathea dealbata*, Swartz; it was 15 feet long.

Mr. Robert Firth, a carpenter at work on the building, was good enough to give me two specimens of the beautiful black and white Geometer, **Declana atronivea*, Walk., also two specimens of the very remarkable elongated Weevils, **Teramocerus barbicornis*, Fabr. [see Plate VI., Fig. 5], and one of the Longicorn *Prionophus reticularis*, White, all of which he had taken about buildings during the previous week. He said that neither of the first two was common. Mr. Firth at one time had been a fern collector, and he told me that he had once come across a Maori stone axe sticking into a tree and covered with the stems of creepers: an interesting and singular find.

The third day's voyage—down to the town of Wanganui—was perhaps the most picturesque of the three, since the river was more open.

Masterton, Wairarapa.

February 25th—March 1st, 1910.

In "Waiomi," the hospitable home of Mr. Donald Donald, I found Moths were looked upon as enemies, because they so often broke the mantles of the gas lights. First and foremost in numbers

and general obviousness was *Persectania ewingi,* which I at once christened the Mantle-moth. Amongst a crowd of them I found a single * *P. steropastis,* Meyrk. Only a little less common than the Mantle-moth was * *Morrisonia mutans.* Several other species came in smaller numbers, to wit: * *M. prionistis,* Meyrk.; * *M. lignana,* Walk.; * *M. homoscia,* Meyrk.; * *Bityla defigurata,* and the pretty little *Cosmodes elegans.* More excitement was, however, caused by the appearance of a larger moth in the kitchen, where, to the surprise of domestics, I secured the handsome Australian *Dasypodia selenophora,* Guen., in fine condition; it has a large steely-blue ocellus on the fore-wings which gives it quite a tropical look; as it is not considered common in New Zealand, I was fortunate in getting a specimen. Our familiar friend *Agrotis ypsilon,* Rott. (*suffusa* Hübn.), deserves mention; it is not very common in the Dominion, but I saw several. Judging from the long series in the National Collection I should say that while the form with a dark central band seems to be equally common in New Zealand and North America, the form with a dark costa is more prevalent at the Antipodes than in other parts of the world. Sir George Hampson notes that the hind margin of the hind-wing is darker in New Zealand examples.[1]

So much for the Noctuae. The most conspicuous among members of other families was **Hemerophila dejectaria*; then there was the little sulphur-coloured **Asthena undosata,* Walk.; * *Cidaria similata,* Walk.; and the common *Emmiltis rubraria.* A solitary *Scoliodes cordalis* was the sole Pyrale seen.

I suppose the Tineid, **Borkhausenia griseata,* Butl., should have precedence over the Swift, **Elhamma signata,* which proved to be common as soon as I had found out its ways; its plan seemed to be to slink in quietly and almost at once settle down below a lamp, on or near the skirting-board.

In the garden the white flowers of the Lace-bark, called by the Maoris "Hoihere" (**Hoheria populnea,* A. Cunn.), were very attractive to such insects as were to be had. On them I netted * *Chrysophanus sallustius* and **feredayi,* also an occasional **Pyrameis gonerilla.* The only Aculeate was *Apis mellifica,* var. *ligustica,* but there were several somewhat striking Flies:—the shining-blue * *Helophilus latifrons,* Schiner (*hochstetteri,* Nowicki); *Pycnosoma* sp.; *Odontomyia chloris,* conspicuous by its partly green abdomen; *Pollenia stygia,* and the large **Hystricia signata,* Walk.

In dead wood I found a colony of **Monomorium antarcticum,* White, var. Sweeping produced abundance of * *Sarcophaga im a tiens.*

[1] "Lepidoptera Phalaenae," vol. iv. p. 369.

Mr. Harley Donald gave me a Weevil, *Otiorrhynchus sulcatus*, Fabr., which he had found in the town: it is cosmopolitan.

Mrs. Arnott was good enough to bring me specimens of the Cockroach, *Cutilia sedilloti*, Boliv., and the deep green Mantid **Orthodera novae-zealandiae*, Colenso, taken in the bush near her house.

One afternoon Mr. Donald drove us over to Matakiwi, a few miles from Masterton, where a bit of bush survives on the bank of an excellent trout stream. Again we were disappointed. A large clump of *Veronica salicifolia* in full flower afforded sustenance to the two *Chrysophani* which fed side by side, but we saw no other Lepidoptera that day. Tearing the bark off logs and digging into the rotten wood, operations in which mine host exhibited great energy, were by no means productive. The commonest Beetle was a *Tenebrio* with a pungent odour; we also got a few specimens of *Cilibe elongatus*, Brème, and with them the Bug, *Rhopalomorpha obscura*, and a lot of the Ant, *Ponera castanea*, Mayr.

While engaged in this almost fruitless search we happened upon five examples of **Peripatus novae-zealandiae*, Hutton. Curious-looking creatures they are, and to me at any rate extremely repulsive. It is now generally agreed that they are primitive Arthropods, having certain affinities with the Annelida. My specimens varied in length from 30 to 40 millimetres, their antennae were black, the body bluish black above, paler beneath, covered with brownish-orange tubercles; the feet were grey beneath.

Mrs. Longstaff took a fine specimen of the introduced Slug, *Arion intermedius*, of an unusually deep yellow colour, also a very dark brown example of *Agriolimax laevis*. In the river she found *Amphipepla ampulla*, Hutton, and **Isodora tabulata*, var. *moesta*, Adams.

On the railway journey from Masterton to Wellington, at Summit Station, 1140 ft., I took **Crambus tuhualis*, Feld., then new to me, as well as the common **C. flexuosellus*.

Wellington.

March 2nd, 1910.

On my second visit to Wellington I had the pleasure of seeing some of that season's additions to the collection which Mr. Augustus Hamilton is making for the Dominion Museum. Mr. Hamilton has determined to make the collection under his charge the standard

one of New Zealand, and in particular is taking steps to secure long series of the many very variable moths of the islands. But there was a greater pleasure in store for me: a night's sugaring with Mr. Hamilton himself, his son, and a Coleopterist whose name has escaped me. The scene of our operations was the wilder part of the Botanical Garden, where the treacle and rum had been spread upon the stems of the numerous Tea-trees. Part of the round was new, part old. Moths were there in swarms; we must have seen more than a thousand. Since many of them were new to me I was as excited as a beginner, yet quite bewildered, not knowing what to catch and what to leave.

My now familiar friend, *Persectania ewingi*, was far and away the commonest moth, and may perhaps have made up three-fourths of the whole number, it was accompanied by a couple of **P. atristriga*, a very distinct species. The great genus *Morrisonia* is best represented in New Zealand, although there are a few North American forms; that night I met with * *M. insignis* and * *M. mutans*, both extremely variable species; the somewhat indefinite * *M. ligniana*, and the more distinct * *M. prionistis*; also several new acquaintances: * *M. ustistriga*, Walk.; * *M. ochthistis*, Meyrk. (*vitiosa*, Hudson, *nec* Butler), and the pretty green * *M. plena*, Walk., which was among the commonest. With all these genuine New Zealanders there was a single straggler of the almost cosmopolitan *Cirphis unipuncta*, which occurs in every continent with the exception of Africa. The Deltoids were represented by one * *Rhapsa scotosialis*.

With * *Coremia semisignata* was to be seen the much less common * *Pasiphila inductata*, Walk.; I also secured an example of * *Declana floccosa*, Walk., one of a most interesting genus peculiar to New Zealand; they are fair-sized robust insects, whose fore-wings, both as regards their shape and the numerous raised scales, at once bring to mind Peroneids of the genus *Leptogramma*, their shaggy look being quite unlike that of any other Geometers of my acquaintance.

But Lepidoptera were not the only insects found on the sugared stems. There were sundry small cryptic Longicorns: * *Somatidia antarctica*, White, and other beetles. Then there were large *Tipulae* of a bright green colour. Among the Orthoptera, besides the Cockroaches, *Cutilia sedilloti* and *Allacta latipennis*, Brunn., two of each, were numerous individuals of the far more striking—not to say alarming—wingless Locustids, the huge * *Deinacrida megacephala*, Buller, called by the Maoris "Weta." One of them when taken was in the act of devouring a hapless * *Morrisonia mutans*, and finished up its carcass on the way home in the pill-box. Although a much

larger species is found in some parts of the Dominion, the mandibles of the male of the common Wellington kind are sufficiently formidable to justify amply the remark of one of the "sugarers," that fewer lovers would walk in those gardens of an evening, if they had any idea how numerous were these awe-inspiring Wetas.

Lyttelton and Christchurch (South Island).

March 4th, 1910.

The beautiful little harbour of Lyttelton seemed to me like a Scotch loch, so shut in is it with mountains. Our time only permitted of a flying visit to Christchurch, which is a sort of colonial Cheltenham. We hurried off to the museum to gaze reverently at the wonderful collection of remains of the * Moa (*Dinornis*) for which it is justly famous. I also had a glimpse of the celebrated Fereday collection of insects. The Domain is more civilized and park-like than some I had seen. The collection of New Zealand plants within a ring fence, forming a separate garden by themselves, especially pleased me. As I have noticed in England so at Christchurch, *Crambi* seem fond of seeking refuge in dense bushy Conifers: the prevalent species on this occasion were **flexuosellus* and **tuhualis*. However, rain cut short my peregrinations, and as I went out I approached a statue from behind, when suddenly its back and shoulders struck me as familiar, they were surely those of my old teacher George Rolleston; on walking round I saw that the effigy was that of the Hon. William Rolleston, formerly Prime Minister of New Zealand, and a younger brother of the Oxford Professor!

The guide-book states that Christchurch Cathedral was designed by Sir Gilbert Scott, the local architect being Mr. E. W. Mountford. It might have been a more inspiring building, if the local architect had made the design as well as superintended the carrying of it out. This remark is made by one who knew something of both men as well as their works.

When we got back to the ship some of the New Zealanders greeted us with, "Well, did not Christchurch strike you as very like England?" to which I maliciously replied, "Yes; the streets were muddy, and it rained most of the time."

DUNEDIN, SOUTH ISLAND.

March 5th—7th, and March 19th—21st, 1910.

If it be true, as I am quite disposed to admit, that Christchurch is an especially English-looking town, there is no doubt whatever as to DUNEDIN being Scottish. The buildings, especially the churches, have a thoroughly Scottish look, and all the streets have Scottish names.

All the more credit to the Scots, for the town is admirably laid out, and from many points of view—especially that of the entomologist—it was a grand idea to reserve a strip of bush all around its landward sides forming the "Town Belt." I wonder whether some entomologist had a hand in this wise scheme.

The high ground above the Town Belt commands grand views over city and harbour, with the big surf rolling in beyond the sandhills. Earlier in the year, and with weather of a less pronounced Scotch type, insects might have been more abundant by day in what remains of the bush; but, even as it was, I managed to pick up a few things. On tree-trunks a few of the pretty little Pug, * *Helastia mucosata* (*bilineolata*), Walk., were to be found, while beating drove out an occasional * *Probolaea falcata*, Butl., * *Asthena subpurpureata*, Walk., or a delicate green Tortrix, * *Nymphostola galactina*, Feld. & Rog., reminding me of our *T. viridana*, though larger and paler, but unlike our British green Tortrix, this is a rarity, according to Mr. Durrant. Another Tortrix found there was * *Carposina adreptella*, Walk. I also obtained, by beating, the Weevil, *Empoeotes censorius*, Pascoe, and dark specimens of the Bug, *Onocontias vittata*, Fabr. In the bush near the cemetery the Pyrale, *Mnesictena notata*, Butl., turned up, it is alike pretty and distinct. One of the commonest trees in the bush was * *Fuchsia excorticata*, Linn.; its small flowers were not out at the time of our visits, but the trees were very conspicuous by their untidy, loose, papery bark.

But quite my best "find" in Dunedin, if not indeed in New Zealand, was Mr. George W. Howes, F.E.S. Owing to a change of his abode I had quite a hunt for him, but ultimately after dark ran him, so to say, to earth. He lives on the outskirts of the town adjoining the best sugaring town in the Town Belt, and there, under Mrs. Howes' guidance, I found him, like many other "good things" —at sugar! Mr. Howes generously placed his "round" at my disposal, and in his genial company I had three most profitable nights—March 5th, 19th, and 20th—moths being plentiful on each occasion.

Perhaps the commonest Noctua was the pretty green * *Morrisonia plena*, which came in considerable numbers; then there were many **M. prionistis*; several **M. ustistriga*; a single **M. homoscia*; numerous * *M. mutans*, variable as its name implies; of * *M. decorata*, Philpott, a species only recently detected, I was fortunate in securing seven; two * *M. agorastis*, Meyrk.; several * *M. stipata*, Walk., a rather large species, notable for the curious tufts of long hair which adorn the sides of the abdomen of the male; a few of the handsome dark * *M. tartaraea*, Butl., turned up, together with * *M. ochthistis*, Meyrk. (*vitiosa*, Hudson, *nec* Butler), and * *M. vitiosa*, Butl. (*proteastis*, Meyrk.). The last two species are decidedly confusing, though unquestionably distinct; they were somewhat mixed up even at South Kensington. Of the dark shiny * *Austramathes purpurea*, Butl., with its overhanging eyelashes, I took two. *Persectania ewingi* had by this time ceased to be of much account, but * *P. atristriga* still interested me somewhat. * *Hyssia moderata* came alone to the treacle, but of * *Leucania sulcana*, Fereday, I got two, and of * *Tmetolophota propria*, Walk., three specimens. In contrast to these the singular and beautiful * *Erana graminosa*, Walk., which when living is of a brilliant green, was quite common. So much of its long and ample hind-wings as projects beyond the skimpy, both short and narrow, fore-wings is of the same green colour as they are. This moth would have interested M. Oudemans.[1] I much regret that I never saw this insect at rest under natural conditions. The curious Deltoid, * *Rhapsa scotosialis*, was fairly common, but I was not able to detect any scent in connection with the tuft of hairs under the costa of the male.

Among the autumn Geometers, which seem in New Zealand to be as fond of sugar as are the Noctuae, the most remarkable were certainly those of the genus *Declana* and its allies, a group that would appear to be confined to the Antipodes. As I said before, they are stoutly made, shaggy insects, which look like gigantic caricatures of Peroneids, or perhaps Notodontids, rather than Geometers. * *Declana floccosa* and * *Anatossa niveata*, Butl., were both fairly common. The Boarmiid, * *Selidosema panagrata*, turned up in some numbers, but * *Hemerophila dejectaria* was not as common as I had found it on the Wanganui. Two specimens of * *Xynonia alectoraria*, Walk., were so very different that I was for some time disposed to think them distinct species, and to call the more aberrant * *X. achroiaria*, Feld., but until evidence to the contrary—by breeding—is forthcoming, it is best to consider them conspecific, as I believe Mr. Howes does.

[1] See Chapter X., § 11, *infra*.

One of the commonest of the family was * *Pseudo-coremia melinata;* with them were two * *P. productata*. The hook-tipped * *Gargaphia muriferata*, Walk., is very common in some parts of New Zealand, but I took one only. The delicate * *Asthena undosata* was common, but * *A. subpurpureata* comparatively scarce; both looked out of place at sugar. * *Coremia aegrota*, Butl., and * *C. semisignata* both visited the sweets, but not in any numbers, and the same is true of the lovely green **Epyaxa beata*, Butl., **Cidaria similata*, and **Helastia mucosata* (also green). In contradistinction to those species, the hook-tipped * *Probolaea falcata*, and * *P. megaspilata*, Walk., as well as **Coenocalpe gobiata*, Feld., were all three common enough, the last-named always reminding me of our British *Phibalapteryx tersata.*

Even in New Zealand the Pyrales hardly go to sugar as freely as they go to light, but the genus *Scoparia* is exceptional in this respect. Our list of sugar-frequenting Pyrales at Dunedin comprised * *Mnesictena flavidalis*, * *Adena hybreasalis*, Walk., a pretty and extremely variable insect, ranging from purple-grey to orange, and the little Endotrichid, * *Diplopseustis perierialis*, Walk. Then of * *Scoparia augastis*, Meyrk., we took three, but of * *S. cymatias*, Meyrk., *S. minualis*, *S. philerga*, and *Xeroscopa rotuella*, Feld., single specimens only.

The extremely variable Tortrix, *Ctenopseustis obliquana*, came to the sugar in considerable numbers, nearly all females. Others of the group were * *Tortrix excessana*, the sexes almost balanced; **Carposina exochana*, Meyrk., a male, while the rare * *Nymphostola galactina* also put in an appearance occasionally. In addition we took a female **Cnephasia jactatana*, Walk., which Mr. Durrant says is a very good thing. A **Deinacrida* sp. was not as numerous as his big brother had been at Wellington and not nearly as formidable looking. Two of the Longicorns, * *Somatidia antarctica*, were very likely not attracted by the sugar at all, but had other business on the trees, and the same may likely enough be true of the Tenebrionid, *Artystona obscura*, Sharp, and *Cilibe elongatus*. The endemic Slug, * *Janella papillata*, Hutton, also visited the sugar.

I was exceedingly anxious to see alive that highly characteristic New Zealand butterfly the silver-washed Satyrid, * *Argyrophenga antipodum*, Doubl., but it would appear that I was quite too late; very probably the bad weather had cleared off the last stragglers. In vain did I try every place that Mr. Howes could suggest.

On the Hill above Normanby, to the westward (March 7th), I picked up * *Coremia semisignata*, * *Epyaxa semifissata*, Walk., * *Asaphodes abrogata*, Walk., which was common in one field among grass,

as well as two specimens of an *Asaphodes*, which Mr. Prout thinks may possibly be distinct from the preceding. Among smaller things were **Scoparia submarginalis*, * *Crambus tuhualis* (which also turned up in the hotel), and * *C. vittellus*, Doubl., and a male of the Tortrix **Proselena hemionana*, Meyrk. The Heteromerous beetles, *Artystona obscura*, and *Adelium* sp., were found under the bark of dead trees.

On Opaho Hill (March 19th) and about the rifle-ranges we got nothing but * *Coremia semisignata*, * *Asaphodes abrogata*, *Emmiltis rubraria*, **Crambus tuhualis*, and the now familiar Asilid **Neoitamus varius*. The Tiger-beetle, * *Cicindela latecincta*, White, was fairly common, and Mr. Howes found one eating a small centipede. He also called my attention to a * *Deilemera annulata* which had just flown into a spider's web. The captor was grey, singularly like in colour to the dead Manuka to which her web was attached. Having mummified the moth the spider tried to haul it up into her dining-room, but after vain attempts descended and cut away a thread which kept the moth down. Having at last pulled up her unfortunate victim, she proceeded to suck its juices, an operation that we watched for some minutes.

St. Kilda sand-hills were visited on March 6th under most unfavourable conditions, and in spite of much struggling about in the extremely dense growth of the Yellow Lupin (*Lupinus arboreus*, Sims)—which had been introduced from California, and most effectually employed, to hold the sand in position—I got nothing save * *Mnesictena flavidalis*, * *Crambus angustipennis*, and a few Tortrices, to wit, three males of *Pyrgotis plagiatana*, Walk., and one female *Ctenopseustis obliquana*. With the moths was an unnamed Ichneumon-fly, while the Beetle, *Cilibe elongatus*, was found under a plank.

Mrs. Longstaff found at St. Clair abundance of the Top Shell, *Diloma nigerrima*, Chemnitz, also a few specimens of the abnormal Limpet, * *Siphonaria australis*, Quoy, which lives at, or even above, high-water mark, but is provided with both a pulmonary cavity, and a branchia, and appears (like *Amphibola*) to be passing from an aquatic to a terrestrial existence.

At Dunedin we had the pleasure of staying in the same hotel with Mr. H. Suter and his wife.[1] The former was kind enough to name Mrs. Longstaff's shells, and to give her much valuable information about them.

[1] We regret to have since heard of her death.

LUMSDEN (SOUTH ISLAND), 27 miles below Lake Wakatipu.

March 8th, 1910.

As the train on its journey northwards approaches the mountains near Lumsden Station it passes through a quantity of Tussock-grass. The wind caused by the train roused many small moths, not a few of which entered the train, but having a very limited supply of pill-boxes accessible, I was able to box but six. These turned out to be one * *Coremia semisignata*, one * *Scoparia paltomacha*, Meyrk., one * *Crambus sublicellus*, and three indifferent specimens of a new species of the latter genus which Mr. E. Meyrick, F.R.S., has described as * *Crambus obstructus, sp. nov.*, adding: "It comes nearest to **C. vittellus*, Doubl. This makes the 38th New Zealand *Crambus*, all endemic, besides an endemic genus developed from *Crambus* (*Orocrambus*) with six species; whilst in Australia there are only two species of *Crambus*, both immigrants." [1]

LAKE WAKATIPU (SOUTH ISLAND), lat. 45° S., altitude above sea, 1069 ft.

March 8th—18th, 1910.

The somewhat severe beauty of Wakatipu is enhanced by the lake being closely shut in by mountains on every side throughout its whole length of nearly fifty miles. If the snow-fields and glaciers at its head bring Switzerland vividly to mind, the lower mountains, with their rugged slopes clothed in dense bracken with here and there woods of birch-like beech, have rather a Scotch character. Unfortunately forest-fires have left many sad scars upon the mountains.

Mr. Howes joined us at the foot of the lake, and his companionship greatly increased my pleasure besides adding to my spoils, for without him I should have done but little night work.

We arrived at Queenstown too late to sugar, so made arrangements to ascend Ben Lomond the next morning. As we rode up, the view looking back over the lake was indescribably lovely; I have seen nothing finer anywhere. The weather had been threatening from the first, and when we drew rein at the hut, just below the col, or saddle, the heavens opened and it began to pour. We waited in the hut, hoping against hope, and gazing wistfully up into the cloud where we knew that the summit must be. The saddle is about 4700 ft.

[1] *Entomologist's Monthly Magazine*, 2nd Ser., vol. xxii., p. 82 (1911). Mr. Meyrick tells me that neither of the Australian *Crambi* occurs in New Zealand.

above sea-level, the summit 1000 ft. higher. We ate our lunch to pass the time, but finally gave up all hope and walked dismally down.

Under such distressing circumstances it was only to be expected that the bag would be but a small one. Belated blossoms of **Gentiana corymbifera*, T. Kirk, and of the Shepherd's Lily (**Ranunculus lyallii*, Hooker), gave us hints of what the New Zealand alpine Flora must be in its prime. At the higher elevations I got nothing but a Grasshopper, which was much in evidence, and a solitary example of what I take to be * *Scoparia axena*, Meyrk. On the lower slopes whenever the sun shone the pretty little **Notoreas brephosata*, Walk., was to be seen commonly enough, though (as Mr. Hudson truly remarks[1]) not too easy either to see or to capture. It derives its name from its striking resemblance to a very small *Brephos parthenias*, Linn., just as a very nearly allied New Zealand moth is called **Dasyuris partheniata*, Guen., although both belong to quite another sub-family of the Geometers. Amongst the common *brephosata* I found a worn example of **N. perornata*, Walk. Somewhat lower down flying about bare stony places in the sunshine might be seen the tiny **Arctesthes catapyrrha*, Butl. This pretty insect Mr. Hudson (following Meyrick) includes under *Lythria euclidiata*, Guen., an Australian species; to me, however, the two insects appear abundantly distinct, and Mr. Prout is of the same opinion. As the lake is approached **Asaphodes abrogata* and **Coremia semisignata* both become common.

That night the rain made sugaring quite out of the question.

The next morning we tried the hill slopes immediately above the town, but, taking what proved to be an ill-judged course, we wasted much time and energy in contending with natural obstacles. Some of the lower slopes around Lake Wakatipu are extraordinarily difficult to climb. It goes without saying that they are steep and rough in the extreme, but they look most innocent in their mantle of fern. This fern—our familiar Bracken (*Pteris aquilina*, Linn., var. *esculenta*,[2] Hook.)—is found, on closer acquaintance, to form a dense tangle about 5 or 6 feet high. I have myself met with Bracken in Jamaica and Ceylon, but I have no hesitation in admitting the superiority of Antipodean Bracken to all other. The difficulty of

[1] "New Zealand Moths and Butterflies," p. 75. Mr. Hudson refers with approval to Lord Walsingham's address to the Entomological Society in 1891, in which the then President expressed the opinion that the brilliantly coloured hind-wings of many day-flying moths dazzled the eye, so as to make it even more difficult for a pursuer to mark the spot where one of them alights than it would be otherwise.

[2] In the old days the rhizome was an important article of diet with the Maoris.

forcing one's self through the thickets was of course intensified when the Bush Lawyer (*Rubus australis*, Forst.) intervened with his many tangling points of argument. Painful experience makes me consider our British Bramble a more deadly foe than the New Zealander. Its prickles are longer and more viciously curved. On the other hand our Bramble is an open fighter, and one need not accept his challenge. The Bush Lawyer, however, is stealthy and underhand in his line of action, preferring ambuscade to front attack, and he wears a sweetly innocent-looking face that seduces the unwary new chum. When fern and bramble found allies in hidden rocks a fall often resulted, and the tired entomologist after extricating himself and recovering his feet had to disentangle his net from the clutches of the Lawyer with such patience as he might haply have left. It is not surprising that a morning so spent added no new species to our list. Another terror of that hillside —and indeed of the whole district—was the Piripiri (*Acaena sanguisorbae*, Vahl., Nat. Ord. *Rosaceae*), commonly known as the "bid-a-bid," a most innocent-looking plant which is, however, so prolific of burrs that a large portion of one's time was spent in picking them off the net. Later in the day I captured in the Domain—here a civilized park, not a bush reserve—a specimen of the cosmopolitan *Zinckenia fascialis*, Cram.

Mr. Howes found a few Snails that morning, and gave to Mrs. Longstaff a specimen of **Laoma celia*, Hutton, one of *Allodiscus mossi*, Murdoch; as well as three **Janella papillata*, Hutton, besides *Agriolimax agrestis*.

In the afternoon Mrs. Longstaff dredged in the shallow parts of the lake for Water Snails. The bottom was in places black with * *Potamopyrgus badia*, Gould, both the smooth and the spiny forms occurring together. It is said that numbers of this mollusc are found in the stomachs of the Trout. But whatever effect the introduction of those voracious fishes may have had upon the fresh-water fauna of New Zealand, it does not seem probable that the *Potamopyrgus* will be soon exterminated. The only other shells met with were * *Isidora lyrata*, Woods; * *Diplodon* (*Unio*) *menziesi*, Gray; * *Pisidium novae-zealandiae*, Prime; and * *Sphaerium novae-zealandiae*, Deshayes.

Mr. Howes, a month before our visit, had left a cyanide-bottle with Mr. T. E. Haines, a very intelligent Queenstown tradesman, who had preserved therein quite a number of moths which had visited the lights of his shop. The most numerous among them were * *Asaphodes abrogata*; the most notable * *Morrisonia phricias*,

Meyrk., and * *morosa*, Butl.; * *Tmetolophota propria*, and * *Leucania semivittata*, Walk., as well as the Phycid, * *Sporophyla denospora*, Meyrk. All of these Mr. Howes was good enough to pass over to me.

On March 10th, we sugared on the path to the waterworks; it was a good night, but the number of accessible trees in the gully is small. * *Hyssia moderata* was common; * *Morrisonia tartaraea* and * *M. prionistis* were also present in fair numbers, and with them were several * *M. insignis*, * *M. phricias*, * *M. mutans*, * *M. lignana*, and * *M. ustistriga*, as well as two each of * *M. ochthistis*, and * *M. dotata*, Walk. Besides these there was a specimen of a grey Noctuid of which we subsequently secured a goodly number. Mr. Howes had taken a single example of the same insect at Dunedin in March, 1907, but it was not until we had secured a long series that it was clearly proved to be undescribed. Mr. Howes was good enough to give it the name * *Morrisonia longstaffi, sp. nov.*[1]

There were, furthermore, quite a number of Geometers: single examples of * *Ipana leptomera*, Walk. (allied to *Declana*); the rare * *Xyridacma hemipteraria*, Guen.; the Pug, * *Helastia mucosata*, and the delicate green *Asthena pulchraria*; two * *Pseudo-coremia lupinata*, Feld., and a number of * *Coremia semisignata*.

The representative Pyrales were * *Mnesictena notata*, *Nymphula nitens*, Butl., the scarce * *Scoparia paltomacha*, and several of the common and variable, * *S. submarginalis*.

Paradise, Wakatipu.

Though difficult of access "Paradise" is quite an earthly place. The drive from the head of the Lake, a dozen miles or so, affords excellent carriage exercise culminating in the passage of the Rees River. This may be described as a vast tract of stones traversed by an uncertain number of streams—seven at the time of our visit. Coming down from the glacier of Mt. Earnslaw, 9200 ft., the Rees is a turbulent torrent subject to sudden freshets, and given to such whims and fancies that the topography of the fords is subject to much uncertainty. After a very heavy fall of rain the best track for vehicles is marked out with flags, but there is still ample scope for good driving. More than once the horses were on the point of swimming, and I do not yet quite grasp how they succeeded in dragging the waggonette over the huge boulders, and up seemingly impossible banks. It did not take much to persuade us that the

[1] G. W. Howes, *Trans. New Zealand Inst.*, vol. xliii., p. 128, Pl. I, Fig. 3 (1910).

road was often impassable; indeed the flood had been so high a few days before that it was not possible to get either into, or out of, Paradise. However, after much plunging and splashing, all difficulties were at last surmounted, and then peacefully driving through a grand bit of Beech forest along the shore of Diamond Lake, we at last entered Paradise by "Heaven's Gate," and had our choice of two accommodation houses, yclept "Arcadia" and "Elysium"!

Paradise Flat is the name of a township, which resembles indeed Eden in "Martin Chuzzlewit" in so far as the town only exists in imagination, but affords a decidedly more pleasant place of residence. At first we thought it might be difficult to live up to the name, but the cold at nights gave a reassuring earthly character to our temporary abode. Our accommodation house provided all the necessaries, and a few of the comforts of terrestrial existence. Perhaps its lamps were somewhat dim, but it is remarkable that they attracted so few moths. However, *Borkhausenia pseudo-spretella* made us feel quite at home.

The township derives its name from a flat stretch of grass land about two miles long, by one mile broad, closed in by mountains on every side except the south-east. Mount Earnslaw lies nearly due north, but its permanent snowfield and glacier are shut out from view by its own lower ridges. To the north and north-west Mt. Sommer (7400 ft.), and other mountains of fine rugged outlines, with their craggy summits capped with snow, seem to wall in the valley. The lower slopes of Mt. Earnslaw and Mt. Alfred opposite to it, are clothed with sombre Beech woods. Between "Arcadia" and the Diamond Lake was a clump of trees, and on the lower ground beyond a golden field of the introduced Ragwort.

There is no doubt that for day work we were too late in the year, though possibly sugar was at its best. The chief insect to be obtained on the flat was * *Chrysophanus boldenarum*, White, which was very common on stony ground where there was but little herbage, the males far out-numbering the females. It is a pretty and very distinct butterfly—purple-blue, not coppery. **Arctesthes catapyrrha* was to be got on the same ground, and **Coremia semisignata* was frequently, and **Coenocalpe gobiata* occasionally disturbed. Other insects met with near the house were * *Mnesictena flavidalis*; * *Scoparia feredayi*, Knaggs; * *S. cleodoralis*, Walk., and * *Crambus flexuosellus*.

On the Ragwort in the noon-day sun we found * *Morrisonia mutans*, *Persectania ewingi*, and the Fly, **Syrphus ortas*, Walk. Other flies taken on the flat were *Odontomyia chloris* and **Hystricia signata*.

Removing bark from dead wood was an unprofitable occupation, producing nothing beyond * *Adelium harpaloides*, White, and countless Bugs of the genus *Neuroctenus*.

It is a good rule when collecting near the coast to make for the sea-shore, and when collecting among mountains to make for the higher levels. Accordingly our first expedition was up the slopes of Mt. Earnslaw.

To reach the upper limit of the bush involved a climb of about 3000 ft. Although there was not even the pretence of a path it was wonderfully easy going for primaeval forest. The trees are practically confined to a species of mountain Beech, almost universally spoken of as Birch. There are several species of these Southern beeches (*Fagus*, the *Nothofagus* of some authors), which all have small, somewhat leathery leaves, and are for the most part evergreen. It seems reasonable to assume that this peculiar foliage is specially adapted to throw off the snow, for no signs of branches having been torn off are seen. At the lower edge of the bush the trees were large, many of them truly noble specimens, but they decrease in size with the altitude until the quite sharply defined upper limit is reached. As with their Northern allies, these beeches like to have the ground to themselves, and there is little undergrowth save young plants of the same species. Bush Lawyers are fortunately few and far between, so that one walked or scrambled over velvety moss with little interruption. Ferns were insignificant in comparison with the North Island.

Above the limit of trees, but before the grassy slopes were reached, was a belt of small scrub through which it was quite difficult to force one's way, and in which it was impossible to catch the few moths that were flying rapidly in the sun. These Mr. Howes believed to be * *Dasyuris partheniata*, a Geometer allied to, but larger and less brightly coloured than * *Notoreas brephosata*. We saw a single * *Pyrameis gonerilla*, near the top of the wood, a species which Mr. Howes says is not nearly so common in the Wakatipu district as it is about Christchurch.

The greatest height that I attained we estimated to be about 3700 ft. above the flat, say 5000 ft. above the sea. The most exalted insect that I came across was the familiar Blow-fly, *Calliphora erythrocephala*, together with some Beetles and a Grasshopper as yet undetermined. There was also a rare Plume, * *Stenoptilia orites*, Meyrk., of which Mr. J. H. Durrant had previously seen the unique type only. A little lower down a *Syrphus*, not in the National Collection, was taken. Not a very distinguished company to find

on stony screes amidst a Flora that was truly Alpine. Mr. Howes is pretty confident that he saw * *Erebiola butleri*, Fereday, but a butterfly rushing swiftly over a scree has pretty well its own way. By industriously turning over stones Mr. Howes found an empty pupa-case of an *Erebiola*, together with several of the Arctiid, * *Metacrias huttonis*, Butl. He also found larvae of * *Hyssia nullifera*, Walk., in the stems of the "Spear-grass."[1] A few of our old friends **Notoreas brephosata* and **Arctesthes catapyrrha*, completed the small company. It was indeed evident that it was quite too late in the season for day work at high altitudes, moreover the famous Alpine flowers were almost all over, a few belated specimens of the Shepherd's Lily being almost the sole survivors.

Another day we went about 1000 ft. up Mt. Alfred, a much lower mountain on the opposite side of the valley. Insects were more numerous but for the most part the same as occurred on the flat. The few exceptions were * *Xerocopa cyameuta*, Meyrk.; a *Scoparia*-like moth which would appear to be uncommon; the Ant, * *Monomoriam antarcticum*, of the typical form; two * *Cicindela parryi*, and another Beetle, a species of *Odontria*.

In the wood at the highest point that we reached, Mr. Howes found under bark of Beech (*Fagus ? fusca*, Hook.) a number of the tiny Snail, **Laoma celia*, Hutton, and several specimens of what Mr. Suter says is a new sub-species, to which he has given the name *alboviridis*.

Mrs. Longstaff obtained by dredging in the Diamond Lake with impromptu instruments, besides * *Diplodon menziesi*, * *Isodora lyrata*, and abundance of *Potamopyrgus badius* and **Sphaerium novae-zealandiae*, a single specimen of *Amphipepla ampulla*.

Land shells were not common, but one or other of the party picked up on the flat, chiefly under bark or logs:—several * *Endodonta* (*Charopa*) *otagoensis*, Suter, one *E. sterkiana*, Suter, one *E. bianca*, one *E.* (*Aeschrodomus*) *barbatula*, Reeve, two *Flammulina pilsbryi*, Suter, one of the very tiny *F. feredayi*, var. *glacialis*, Suter, one *Thalassohelix traversi*, E. A. Smith, and one * *Laoma phrynia*, Hutton. All these were small shells, and such as may be easily overlooked. We did not have the good fortune to enter the circumscribed area of distribution of the only large New Zealand land shells of the genera *Placostylus* and *Paryphanta*. The poverty of the New Zealand land mollusca is indirectly shown by the rapidity with

[1] **Aciphylla squarrosa*, Forst., Nat. Ord. *Umbelliferae*; the genus is confined to New Zealand. Not be confounded with the Spear-grass of India (see above, p. 70), which is a true grass.

which *Helix aspersa*, and several European slugs have spread over the country: there were evidently vacant spaces waiting for them, so to say.

The beeches along the lower margin of the bush between "Elysium" and the lake afforded an ideal sugaring ground, with which we sometimes included the more scattered trees on the lower grass-land. When going to and from our sugar we were somewhat put out by having to cross barbed wire fences that appeared to have no other object than to annoy, but at last it dawned upon us that they were there to define a street through the township, although the said township comprises but three houses, none of which abut upon the future street.

We got five nights sugaring on this splendid ground and have no reason to complain of the results. *Agrotis ypsilon*; * *Hyssia griseipennis*, Feld., in fair numbers; * *Morrisonia plena*, abundant; * *M. mutans*, common; * *M. vitiosa*, common; * *M. rubescens*, Butl., one; * *M. ustistriga*, one; * *M. stipata*, several; * *M. dotata*, one; * *M. longstaffi*, Howes, one; * *M. ochthistis*, two; * *M. tartaraea*, two; * *M. lignana*, one; * *M. phricias*, rather common though not generally considered so; * *Morrisonia alopa*, Meyrk., this species, included by Mr. Hudson (following Mr. Meyrick) in *Leucania*, but placed by Sir George Hampson in *Morrisonia*, had hitherto been looked upon as a great rarity, but at Paradise during our visit it was quite common; it always reminded me of our *Sideridis* (*Leucania*) *lithargyrea*, Esp.; * *M. merope*, Hudson, we took a splendid specimen of this grand insect, it is a rather large Noctuid, blue-black with metallic green markings; it is considered to be a great rarity, and it certainly looked the part under the bright light of the acetylene lamp; * *Leucania semivittata*, several; * *L. sulcana*, one; * *Bityla defigurata*, fairly common; *Persectania ewingi*, common; * *Tmetolophota propria*, one; * *Ariathisa* (*Orthosia*) *comma*, Walk., two; * *Rhapsa scotosialis*, three.

The list of sugar-frequenting Geometers is even a longer one than that of the Noctuids. * *Hemerophila dejectaria*, one; * *Selidosema panagrata*, several; * *Pseudo-coremia lupinata*, five; * *P. melinata*, several; * *P. productata*, three; * *Declana griseata*, Hudson, one, a species not represented in the British Museum; * *D. floccosa*, two; a very fine *Declana*, with well-defined black markings, visited my sugar once when I was some distance from Mr. Howes, though I felt quite certain that it had been bottled all right, somehow I never saw it again; * *Ipana leptomera*, two; * *Gonophylla fortinata*, Guen., two; *Asthena pulchraria*, several: this is of a very delicate green when quite

fresh; the pale grey * *A. subpurpureata*, three; *A. visata*, Guen., two; * *Tatosoma agrionata*, Walk., two males: this was my first, and only acquaintance with living specimens of this peculiar genus, in which the male is conspicuous by its abnormally long abdomen and contracted hind-wings, its nearest ally in the British fauna is *Lobophora*; *Coremia aegrota*, abundant; * *C. semisignata*, abundant; * *C. cineraria*, abundant; * *Epyaxa semifissata*, two; *E. rosearia*, Doubl., one; * *Coenocalpe gobiata*, common: this is so variable that it is hard to say whether or no two species are included under the name; * *Xyridacma hemipteraria*, one, considered somewhat of a rarity by Mr. Howes; the dark green * *Cidaria similata*, abundant; * *Elvia glaucata*, Walk., we took three of this very pretty little species; lastly, * *Helastia mucosata*, one.

If my records are to be trusted, the only Pyrales that visited the sugar at Paradise were members of the genus *Scoparia*. Of these * *submarginalis* was common enough; of * *minusculalis*, Walk., three came; but only single individuals of * *philerga*, * *astragalota*, Meyrk., and * *characta*, Meyrk. There were several specimens of * *Tortrix excessana*, also a worn Tineid of the *Laverna* group.

Several of the Cockroach, *Temnopteryx* sp., which I had previously met with in several places, and a few of the Weevil, *Rhyncodes ursus*, White; one *Artystona obscura*, as well as two of the Longicorn, * *Somatidia antarctica*, were found upon the trees, but whether the three latter were attracted by the sugar is questionable.

The return journey to Queenstown gave us a little time at Glenorchy at the head of the lake. In the small garden of the hotel, on an ill-kept lawn a Geometer, an *Asaphodes*, previously taken near Dunedin, was somewhat common. Mr. Prout considers it to be new and has promised to describe it in due course. Under driftwood at the edge of the lake were a very few beetles, including *Odontria* sp. Mr. Howes had left one of his cyanide-bottles with the hotel proprietor, it now contained a few of the large * *Hyssia nullifera*.

On our way up the lake, when the steamer called at Kinloch, Mr. Howes found several small Land Shells; two * *Charopa otagoensis*, Suter, and eight *Aeschrodomus stipulatus*, Reeve.

Queenstown (Lake Wakatipu).

March 16th.

On our arrival Mr. Howes at once rushed out and sugared a few trees near the town. There were not many moths, amongst them the predominating species was *Persectania ewingi* and with it were a very few * *Hyssia moderata*, * *Morrisonia phricias*, * *M. tartaraea*, * *M. prionistis*, * *M. mutans*, a couple of * *Coremia semisignata*, and a * *Crambus sublicellus*. The feature of the evening was a splendid specimen of what Mr. Hudson calls * *Melanchra pictula*, White; a green and black insect with white reniform stigma and pink hind-wings, now called by Sir George Hampson, * *Miselia meyricci*.

That night Mr. Howes captured at the lamp in the hotel porch a very fine specimen of * *Euxoa admirationis*, of a markedly grey tint.

Beyond taking a few * *Chrysophanus boldenarum* on the shores of the Frankton Arm, I did little the next day till late afternoon when we rode about 2000 ft. up Ben Lomond, sending the horses back. Mr. Howes scrambled down to the edge of the bush to lay on the sugar, while I took the "billy" to fetch water—a process that somehow brought to my mind the doings of the 10th Legion under Julius Caesar. It was much further than I thought, and, too late, I regretted the premature dismissal of my horse. Truly there was water in the ravine below the sugaring ground, but it was hopelessly inaccessible, so I had to climb up quite 500 ft. to a tiny stream to fill my billy, moreover I had to carry it down again without spilling. For this difficult operation I luckily proved to have a natural talent. Proudly depositing my (nearly) full tin in a position of security I set to work to build a fire-place and to collect dead wood. When all was ready Mr. Howes turned up with brush and pot. I can recall few things more delightful than sitting at the close of day on the mountain-side in the one approximately level spot, drinking our tea and eating our food with the proud feeling that we were doing what no mortal entomologist had ever done before. The solitude, the wild beauty of the place and the keen sense of anticipation were most delightful.

The upper edge of the bush had been sugared: mostly small trees clinging on to the rocky soil, and needing free use of the knife to clear their stems of superfluous twigs. Of a track there was no manner of trace, but by skilful use of toes and heels it was just possible to walk on what was little better than a Cumberland scree.

It is not a little to our credit that, according to my recollection, we did not fall down more than twice each, moreover no serious damage was done to bones, or lamps, or killing-bottles.

We met with our reward. Moths were scarcely numerous, but the quality was good. There were odd specimens of **Morrisonia ochthistis*, **M. homoscia*, **M. ustistriga*, **M. mutans*, **M. dotata*, **M. phricias*, and **Tmetolophota propria.* Both *Persectania ewingi* and **Morrisonia prionistis* were fairly common. Of **Morrisonia longstaffi* I was fortunate in bringing home five specimens, but our great take was *Miselia meyricci* of which we got several, it is usually considered quite a good thing, besides being so beautiful. Mr. Howes saw, in addition, **Miselia pessota*, Meyrk., but unfortunately it got away. Moths of other families were conspicuous by their absence.

Thus ended, very appropriately, our expedition to Lake Wakatipu, an expedition which I shall always associate in my mind with boyish collecting with John Blackburn on the shores of Loch Rannoch. Each Lake owns a Kinloch; the terrain of the two places is similar; the general character of the fauna is also similar. It is especially notable that the moths of the Highlands of Scotland and those of the Highlands of New Zealand are alike extraordinarily variable.

Lyttelton (South Island).

March 23rd, 1910.

On the occasion of my second visit to the beautiful lake-like harbour of Lyttelton I did not go far inland. Mrs. Longstaff was very anxious to get living specimens of *Turritella vittata*, which Mr. Suter had told her were to be obtained in the harbour. Accordingly we set off to the locality indicated, Magazine Bay, but were just too late, for the tide had turned, and although there were dead spires in abundance, no living animals were within reach.

Magazine Bay was not very productive in the insect way, but **Pyrameis gonerilla*, **Chrysophanus sallustius*, **Mnesictena flavidalis*, **Crambus ramosellus* and *Eristalis tenax* all turned up, while *Emmiltis rubraria* was abundant in a circumscribed spot. It is noticeable that I did not see this last species in the Wakatipu district.

In the afternoon I ascended Mount Pleasant, at the head of the harbour; with an official altitude of 1638 ft., it rejoices in the native name of Tauhuno-korokio. It is a pretty little mountain commanding

a wide-ranging view, and earlier in the season should afford good collecting ground. **P. gonerilla* and **C. sallustius* occurred alike on the lower slopes and on the very summit. In vain did I tramp up and down acre after acre of rough tussock-grass (*Poa caespitosa*, Forst.), in the hope of perchance picking up a belated specimen of * *Argyrophenga antipodum*; there was nothing to be found but * *Asaphodes abrogata* in the grass, and * *Scoparia axena* on lichen-covered rocks. At about 900 ft. a female of * *Coremia bulbulata*, Guen., was taken flying in the afternoon sun, and at a little lower level *Asthena undosata*, and the common * *Coremia semisignata*. Almost by an accident a **Morrisonia mutans* was seen on a grey tree-trunk, which it very closely resembled in colour. There were a few beetles under stones in what remains of the bush—*Cilibe elongatus*, Brème, and one of the large and handsome, but very evil-smelling Carabid, * *Megadromus viridilimbatus*, Motsch. Under a stone I found six small Snails, *Therasia valeria*, Hutton.

My last night in New Zealand was spent very pleasantly with Mr. Hudson, in his well-situated house overlooking Wellington, chatting over his fine collection.

AUSTRALIA.

Sydney, New South Wales, lat. 33° 50′ S.

March 30th—April 5th, 1910.

If you are going to Sydney as a stranger do not arrive on Easter Monday, when The Cup is run for, especially if the Agricultural Show be going on at the same time. The "Manuka" arrived a day before it was expected, so my son did not meet me. Every hotel was full, as were the many boarding-houses. After much tramping about we had to put up with two very dirty trestle-beds, in the attic of a third-rate boarding-house; the women servants were out, the men servants were drunk!

Quite apart from its well-praised harbour, Sydney pleased me more than any city of Australasia. Its very irregularities make it interesting. It seems to sit upon its site in a dignified manner. True, its suburbs, though open and airy, are depressing, like most suburbs, but the business quarters of the city have a solid respectability, and its flower-bedecked park or Domain forms a delightful centre for its busy life.

In the said Domain I took a specimen of *Papilio sarpedon choredon*, Feld., which with fluttering wings was regaling itself at a bed of Zinnias. A second very small specimen was taken at Balmoral on the north side of the harbour. In the Botanic Gardens, adjoining the park, there were numbers of butterflies. *Belenois teutonia*, Fabr., was in abundance about the *Capparis* bushes on which its larva feeds. There were many pupae on the *Capparis*, but for some unaccountable reason none of them produced butterflies. Of two *Precis velleda*, a male was "very dry," a female intermediate. Single examples of *Polyommatus baeticus*, Linn., and *Zizera labradus* were taken. Skippers were very numerous, *Telesto perronii*, Latr., predominating, all captured were males; of *Telicota sperthias*, Feld. (which seems to me to be very closely allied to, if not identical with *augiades*, Feld.), two males and a female were captured. I also secured an insect identical with that labelled *Ocybadistes* (?) *flavoguttata*, Plötz, in the British Museum Collection. The cosmopolitan Pyrale, *Zinckenia fascialis*, Cram., was abundant among the S. American plant, *Gomphrena globosa*, Linn. One specimen of the blue-black Wasp, *Discolia soror*, Smith, turned up.

At Rose Bay, a suburb between Sydney and the sea, there is a little bush left. This harboured fewer insects than I had expected, but there was one that much interested me. *Tisiphone abeona*, Don., is a very handsome Satyr, a large nearly black butterfly with creamy markings. It was almost confined to the immediate neighbourhood of a small spring—not a common object in the New South Wales landscape—and had a remarkably slow, dancing, flapping flight. I could not detect any trace of scent in either sex, dead or alive. The only other butterflies taken in the bush were single specimens of the Satyr, *Hypocysta irius*, Fabr., and the Skipper — *lascivia*, Rosenstock (for which a generic name is at present wanting), but *Zizera labradus* was common in a damp meadow below the wood, where also a bright green *Tryxalis* sp., was abundant. I also got at Rose Bay a specimen of the Lithosiid, *Asura lydia*, Don., a black and yellow somewhat Syntomid-like moth; two of the Australian Ladybird, *Coccinella conformis*, and a Bombyliid of the genus *Anthrax*, not represented at South Kensington; besides these there were a few Ants, *Ectatomma metallicum*, Smith, found under a stone.

At Woolahara Point, not far from Rose Bay, I took two *Syntomis annulata*, Fabr., flying late in the afternoon, also single examples of the Skippers, *Ocybadistes* (?) *flavoguttatus*, and — *lascivia*, Rosenstock. I also saw several of my old friend *Zinckenia fascialis*, and found an *Adelium* crawling on a rock. Miss Ruby Gower kindly

gave me a specimen of the fine buff-coloured Australian Lymantriid, *Colussa excisa*, Walk., a male, which she had found in the house.

Acting on the advice of Mr. G. A. Waterhouse, B.Sc., I made two expeditions by rail to Como on the south bank of the River Georges, a well-known suburban locality, about twelve miles SS.W. of Sydney, not very far from the spot where Banks made his collection, which was afterwards named by Fabricius, so that it is not surprising that many of my captures were of Fabrician species.

To wander in the Australian bush, where the Gum-tree has its home, was a new experience, but I wish it had been earlier in the year. It was soon evident that the prevailing butterflies were Satyrines and Hesperids. The large *Heteronympha merope* was quite common, it is more wary than is usual with Satyrs, and somewhat swift of flight. Curiously enough I saw at Como nothing but females, just as at Hobart, ten weeks previously, I had seen nothing but males; moreover so unlike are the two sexes that I had no idea that they were one species. It is remarkable that the female of *merope* has a distinct sweet scent of the *Philadelphus* type. Perhaps the commonest butterfly was *Hypocysta irius*, Fabr. (*adiante*, Hübn.), but of its congeners, *H. antirius*, Butl., and *H. euphemia*, Dbl. & H., I took but one each. *Xenica achanta*, Don., a very golden-looking insect on the wing, was suggestive of *P. megaera*; unfortunately, though common, it was in poor condition. Near the railway station I picked up a couple of *Yphthima arctous*, Fabr., which took my thoughts back to India.

Precis velleda was somewhat common, but I did not see any other Nymphalines.

The only Danaine was a female *Danaida archippus*, Fabr. (*plexippus*, *auct. nec* Linn.).[1]

Theclinesthes (*Nacaduba, Utica*) *onycha*, Hew., *Nacaduba biocellata*, Feld., and *Zizera labradus* were all the Blues that I took, and judging from their condition the family was about over. At Como I saw but one Pierine species, but that a notable one; the male of *Delias nigrina*, Fabr. (the only sex that I secured) is white above, black beneath, a startling colour scheme. A fair number were seen flying about the flowers of a tall gum-tree, but they rarely condescended to come down.[2]

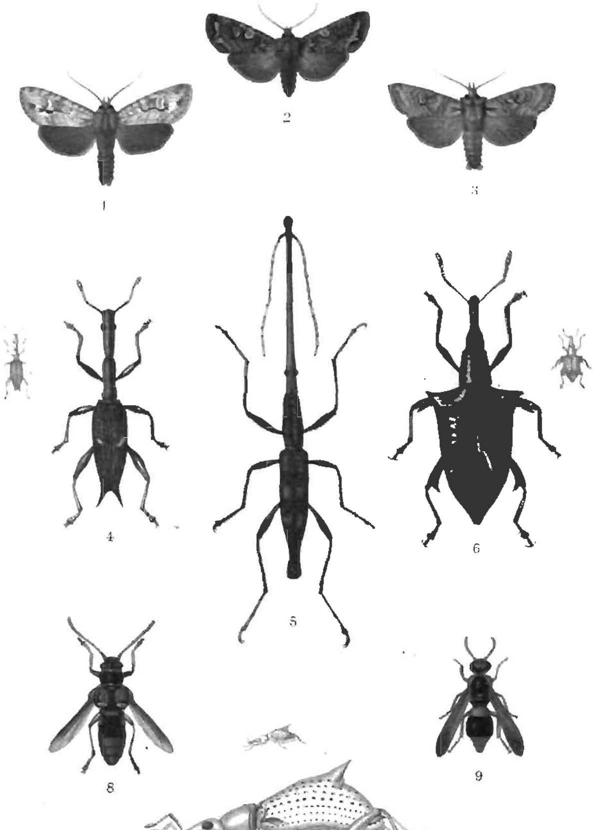
Skippers, as has been said, were much in evidence, affording a marked contrast to New Zealand, where they are unknown. Of the brilliant tawny *Telicota augias*, Linn., which occurs throughout the

[1] Mr. G. A. Waterhouse calls this *megalippe*, Hübn.

[2] See below, p. 535.

Plate VI.

AUSTRALASIA



H. and Edgar S. Knight del. West, Newman Chromo.

1. MORRISONIA SEQUENS.
2. MORRISONIA CHLORODONTA.
3. *MORRISONIA LONGSTAFFI.*
4. RHADINOSOMUS ACUMINATUS.
5. TERAMOCERUS BARBICORNIS.
6. SCOLOPTERUS TETRACANTHUS.
7. *THE SAME SIDE VIEW.*
8. ESTHESIS VARIEGATUS.
9. RHYNCHIUM ABISPOIDES.

Oriental Region, I took three; of *Pallasingha phigalia*, Hew., two, of *P. petalia*, Hew., one, remarkable among Skippers by having an ocellus-like mark on the underside of the hind-wings; *Trapezites iacchus*, Fabr., one, worn; *Ocybadistes* (?) *flavoguttatus*, one; *Telesto doubledayi*, Feld., a female, *T. perronii*, a female, and *Oxytoxia ismene*, Newm. (*parvulus*, Plötz), one.

Conspicuous among the Moths was the Agaristid, *Phalaenoides tetrapleura*, Meyrk., of which I fancy I saw several, but only secured a single female; the British Museum has males only, from Queensland. Of *Syntomis annulata* (the typical form) I took three, it is evidently very common in the Sydney district. The black and yellow Lithosiid, *Asura lydia*, turned up again. There were but two Geometers, *Epidesmia tryxaria*, Guen., an Oenochromiid which is superficially like our *Panagra petraria*, Hübn., and *Idiodes inspirata*, Guen., which is doubtfully distinct from *mitigata*, Guen. The sole Pyrale was *Endotricha pyrosalis*, Guen.

Hymenoptera were moderately plentiful. Of *Apis ligustica* I took three, two of them in the deadly embrace of *Asilus discutiens*, Walk. On the characteristically Australian "bottle-brush" flower of a species of a *Callistemon*, I took *Prosopis alcyonea*, Erichs. (*vidua*, Smith). The blue *Crocisa nitidula*, Fabr., was brilliant, even for its genus. I took but one *Dielis formosa*, Guér., though others were seen. On a Mimosa flower I saw, as I thought, a very fierce-looking, black and orange Wasp, it was easy to sweep it off the flower with the net, but difficult to coax it into the cyanide-bottle; for some occult reason I had an especial fear of that insect, recalling a yarn of Commander Walker's about a specially deadly wasp of those latitudes. At last it went into the bottle and I thought no more about it, until on getting back to my hotel at Sydney, I turned the contents of the bottle out, to find that my Wasp was a female Longicorn beetle, *Esthesis variegatus*, Fabr.! Mr. G. Meade-Waldo and Mr. Rowland E. Turner think that its model is probably *Rhynchium abispoides*, M.-Waldo, but it is also very like a small male of *Salius bicolor*, Fabr., of which I had caught a female at the same place three days before [see Plate VI., Figs. 8, 9]. On the stem of a *Eucalyptus* I found the Sawfly *Pterygophorus* (*Perga*) *cinctus*, Klug, half-dead. Communities of *Camponotus novae-hollandiae*, Mayr, were not uncommon.

An expedition to Edward's Bay, on the north side of the harbour, in search of Marine Mollusca was productive of a large number of specimens which have not yet been worked out.

By the kindness of Mr. R. Hedley we attended the annual

meeting of the Linnaean Society of New South Wales, and had a very pleasant evening; another evening I spent with Mr. G. A. Waterhouse, and his collaborator Mr. G. Lyell, junr., discussing their forthcoming work on the butterflies of Australia. One afternoon we went to the fine University Building, where Professor David gave us tea, illustrated by a private exhibition of a wonderful set of lantern slides of the Antarctic Expedition.

HOBART, TASMANIA.

April 8th and 9th, 1910.

Our second visit to Hobart gave us part of two days ashore. A walk in the Gum-woods above the Cascade Brewery showed them to be singularly barren of insect life, probably in great part owing to the paucity of undergrowth. Two worn specimens of the Satyr, *Xenica klugii*, Guér., were taken, also a tattered male of *Heteronympha merope*, a couple of *Emmiltis rubraria*, and one *Asthena visata*, both New Zealand friends. I also got two of the Crambid, *Talis grammellus*, Zell.

The next morning was spent in the Botanic Garden, where *Precis velleda*, small "dry" specimens, was flying in swarms about French Marigold and Heliotrope. I never saw any of the genus so abundant elsewhere. The only other butterflies were the widely-distributed but unattractive *Zizera labradus* and a few females of *Heteronympha merope*. I beat out a Lithosiid, *Palaeosia bicosta*, Walk., a moth very like our *Lithosia griseola*, Hübn.

MELBOURNE, VICTORIA, lat. 37° 47′ S.

April 11th and 12th, 1910.

To my mind the magnificent Botanic Garden is the chief glory of Melbourne, a city which has the distinction of containing a larger proportion of the population of the state of which it is the capital than is the case anywhere else.

Besides plenty of *Zizera labradus*, a female *Heteronympha merope* and the almost inevitable *Eristalis tenax*, I had the pleasure of taking in the gardens several specimens of *Pyrameis itea*, chiefly at the flowers of the Mexican *Lantana sellowiana*, Lnk. & Ot.

The next morning I went to Sandringham, a sea-side resort on the shore of Port Philip Bay. On a heath-like expanse were many low shrubs of what I took to be *Callistemon salignus* [Nat. Ord. *Myrtaceae*],

whose yellow bottle-brushes irresistibly reminded me of male sallows, however, they yielded nothing but *Apis ligustica* and some obscure little flies. It was too dull and windy to do any good, but just before leaving I glanced over some close palings with the result that I soon found *Zizera labradus*, very cryptic; *Hemerophila mundifera*, Walk., and three other moths which puzzled me greatly at the time. They were exactly the colour of the fence; their wings folded in such a way as to make them resemble a Footman, or a very small Shark. They turned out to be the Geometer, *Chlenias carburaria*, Guen.; a closely allied species is actually called *umbraticaria*.

Adelaide, South Australia, lat. 35° S.

April 14th, 1910.

We took train to the city and then motor-car to Waterfall Gully. There was nothing to be seen save *Danaida archippus* and *Heteronympha merope*, females.

Alongside the quay where the steamer was moored, was a quantity of made-ground, in part at any rate the result of dredging. An almost fruitless search for insects in country very like parts of Braunton Burrows only yielded a Crambid, *Argyria pentadactyla*, Zell., and a couple of Earwigs, but a very few minutes before the hour of sailing I came across a place where wind and rain had exposed immense numbers of marine shells—mostly Gasteropods. In a very short time I picked up a considerable number: they have not yet been worked out but appear to comprise *Fusus*, *Turritella*, *Conus*, *Oliva*, *Bulla*, *Murex*, *Natica*, *Cerithium*, *Trochus*, *Pleurotoma*, *Pecten*, and *Venus*. The majority are unquestionably recent, but some would appear to be semi-fossilized: among them are numbers of Foraminifera resembling Nummulites. It would have been far more profitable had we spent the whole day over these shells, a large proportion of which were in excellent preservation.

Fremantle, Western Australia, lat. 32° 20′ S.

April 18th, 1910.

The Great Australian Bight was exceptionally benignant when we crossed it, and might almost have set an example to the proverbial mill-pond. At Fremantle we spent such time as was at our disposal in driving to Apple Cross, on the Swan River. The bush was interesting because curious, but I might have had better collecting on

the Sahara. The only butterflies were a couple of *Polyommatus baeticus* and one *Nacaduba biocellata*, Feld. (*armillatus*, Butl.), taken at the flowers of what seemed to be a species of Broom. A Gum-tree in flower had attracted *Apis ligustica*, *Paracolletes plumosus*, Smith, and *P. bicolor*, Smith, as well as *Epactiothynnus cygnorum*, Turner. All these were taken at Palmyra, a suburb of Fremantle. The bush yielded the wasp, *Salius bicolor*, Fabr., and an Aoridian, *voila tout!*

This yarn was told by a humorous Scot, if ever there was one, on the North Pacific, but was brought to mind by the Scottish city of Dunedin:—

One New Year's morning a Scotch Minister sallied forth accompanied by his ruling Elder to call upon his chief parishioners, as is the custom. It was a fine morning, but cold. All went well, they found almost every one at home and wished each in turn "a guid New Year," which was duly reciprocated. The Minister was welcome to his hospitable parishioners; as has been said it was a cold morning and naturally enough the whisky bottle was handed round.

Noon drew near, and soon after leaving a house the Minister, addressing his Elder, said—

"Sandy McPherson, I'm thinkin' that mebbe we've drunk a drap mair whusky than is seemly for folk in our responsible poseetion. Will ye juist walk on a wee bit, and I'll bide here and see whether ye can walk straight or no."

The Elder thus exhorted walked on a hundred paces or so, when the Minister again addressed him?

"Ye can turn back, Sandy, ye're daein fine, but," dropping his voice, "wha's that wi' ye?"

On the voyage home, when in the Red Sea before dawn on May 5, I had a lovely sight of Halley's Comet, Venus, and the New Moon in conjunction, all close to the eastern horizon.

On May 18, at 4 a.m., in the Bay of Biscay, the head of the Comet was below the horizon, but the tail, which was hazy and pointed at the end, appeared to be at least 2½° broad and extended at least 50°. I imagine it must have been very near to the earth.

CHAPTER X

BIONOMIC NOTES, CHIEFLY ON BUTTERFLIES[1]

§ 1, Scents—§ 2, Coloured Juices—§ 3, Tenacity of Life—§ 4, Mutilations by Foes—§ 5, Experiments on Palatability—§ 6, Successful Mimicry—§ 7, Peculiarities of Flight—§ 8, Heliotropism—§ 9, List and Shadow—§ 10, Inverted Attitude—§ 11, Attitudes at Rest—§ 12, Some Cosmopolitan Lepidoptera—§ 13, Seasonal Forms—§ 14, Selection of Coloured Resting Places.

INTRODUCTORY.

WHEN travelling in a country new to him it is almost inevitable that an entomologist's time should be chiefly taken up with searching for insects and securing specimens; his temptation is to become a mere collector, his chief ambition to discover species new to science. Further, such observations of more scientific value as he may find time to make are but too apt to be isolated, imperfect and inconclusive. Yet something may be done even during a flying visit, and a subsequent judicious arrangement of the notes made at the time may provide useful material for further work by the same naturalist, or by a more capable or more fortunately circumstanced observer following his footsteps.

But it may be objected to such a book as this, that it is made up of trivial details, that it is loaded with wearisome repetitions, that everybody has long been familiar with the facts brought forward—in short, that it is but a laborious "demonstration of the obvious."[2] So be it. For the sake of argument these propositions might all be admitted, and yet the time spent in writing the work, and even the space occupied by it upon the bookshelf, be amply justified.

The immortal work of Lyell, of Darwin, and of Wallace was largely built upon seeming trivialities, on facts many of which were

[1] This chapter is based upon two papers read before the Entomological Society of London, viz.: "Some Rest-Attitudes of Butterflies," *Trans. Ent. Soc. Lond.*, 1906, pp. 99–118; and "Bionomic Notes on Butterflies," *ibid.*, 1909, pp. 607–673. The term "Bionomics" is due to Sir Edwin Ray Lankester, K.C.B., F.R.S., and may be shortly defined as that section of Biology which deals with the laws regulating the mutual relations of living organisms.

obvious, and therefore to some persons uninteresting. But with what different eyes do we now look upon those same facts, filled as they are with new meaning! Surely present-day naturalists cannot do better than follow humbly in the footsteps of those "old masters," observe, record, and arrange facts, extract and dress the ore ready for some future metallurgist to smelt, so that some future smith may have the wherewithal to forge useful tools or works of art.

Far more experienced observers than the writer have unfortunately lacked the time or the inclination to place their facts on record. Indeed, it is one of the saddest things in the history of science that so much knowledge has perished with the gleaners.[1] Again, even though the facts may have been recorded previously, it is surely well that they should be confirmed time after time before hasty inferences are drawn. Yet again, it is surely desirable to find out how far the facts extend, to what species, genera, families; to what degree they are developed; whether they vary in the two sexes, in the individual, the species, the genus; how they are distributed in space and time and season. Lastly, it is just possible that here and there a seemingly small fact, a residual phenomenon of real import, may have hitherto escaped observation, or at any rate may not have been recorded.

It has been the author's idea to place together in some sort of order those of his observations which have from time to time appeared to him to be of real importance, with a view to focusing, as it were, all the scattered facts, in the hope of illuminating, even to a small degree, sundry holes and corners in the great mystery of evolution.

§ 1. Scents of Butterflies.

Doubtless from the earliest days that insects have been collected entomologists have from time to time noticed scented butterflies, and the records of such occurrences must be scattered here and there through entomological literature, but so far as I am aware Fritz Müller was the first to take up the study of the subject seriously. As early as 1876 he suggested that all the various brands, tufts of hairs, pouches, and the like, which are peculiar to the males of various butterflies, might be odoriferous organs, although up to that time he had himself actually detected scents in but few species.[2]

[1] Col. C. T. Bingham's diaries were in my mind when writing this; he died the week after the original paper, on which this chapter is founded, was read. He was a keen observer, and the most genial of men.

[2] *Jenaische Zeitschrift für Naturwissenschaft*, 1876, XI., p. 99. By the kind assistance of Mr. E. A. Elliott and Prof. Poulton I am enabled to give in an Appendix translations of this and other papers by Fritz Müller.

In 1878 Fritz Müller followed this up with an extremely interesting communication to the Entomological Society of London,[1] dealing chiefly with the scents actually found by him in the field, scents often associated with the special structures referred to.

Mr. J. Wood-Mason, in 1886, published an account of the results of some of his observations in Cachar (Assam).[2]

Dr. F. A. Dixey, F.R.S., took up the study where Fritz Müller left it, and has been for some years engaged in investigating the anatomical structures connected with the production and distribution of the scents, devoting especial attention to the *Pierinae*. He gave the scientific world the first instalment of his results in his able Presidential Address to the Entomological Society, in January, 1910.[3] Entomologists have been long looking forward to the publication of his researches, and it is to be hoped that before very long the complete work will see the light.

Dr. Dixey's first field observations appear to have been made in 1899. Four years later, at Mortehoe, shortly before I sailed for India, he called my attention to the strong and distinct scent of *Ganoris napi*, Linn., closely resembling that of the Lemon Verbena, *Lippia* (*Aloysia*) *citriodora*.[4]

We made some joint observations that summer which I repeated and amplified the next year. Dr. Dixey gave a detailed and very lucid account of these early observations to the Entomological Society, an account that will well repay perusal.[5] Meanwhile, at Dr. Dixey's request, I had made a few observations on Indian butterflies in 1903–4.[6] It is curious that to this day so few persons are practically acquainted with the scent of the Green-veined White. When, at the Brussels Conference, in 1910, I caught a male *G. napi* in the beautiful garden of the Congo Museum, and demonstrated the scent to half a dozen entomologists present, none of these gentlemen had perceived the scent before, though at least one of them was a very eminent observer.

[1] "Notes on Brazilian Entomology," *Trans. Ent. Soc. Lond.*, 1878, p. 211.

[2] "The Rhopalocera of Cachar," by J. Wood-Mason and L. de Nicéville. *Journal Asiatic Society of Bengal*, vol. xv., 1886, pp. 343–393. It is stated on p. 344 that this paper was *written* in 1881, but its publication was delayed. The insects were taken "between March 26th and October 4th," but the year is not given.

[3] *Proc. Ent. Soc. Lond.*, 1909, p. lxxxiii.

[4] See A. Weismann, "The Evolution Theory," 1904, translated from Second German Edition, 1904, pp. 217, 218. Also Barrett's *British Lepidoptera*, 1893, vol. i. p. 26; also Standfuss, *Handbuch der paläarktischen Gross-Schmetterlinge*, 1896, p. 108.

[5] *Proc. Ent. Soc. Lond.*, 1904, pp. lvi.–lx. See also Longstaff, *Entom. Month. Mag.*, 1905, pp. 112–115.

[6] Longstaff, *Trans. Ent. Soc. Lond.*, 1905, pp. 136–138.

In 1905 I had the pleasure of travelling with Dr. Dixey in South Africa, and shortly after our return he communicated to the Society the results of our observations in that country. His papers[1] deserve very careful study. They call for one remark from me, and that is this: considering the difficulty of the subject it is quite remarkable how closely we agreed in the great majority of cases; where we differed our very differences proved the honesty and independence of our observations. There is no question in my mind that Dr. Dixey's olfactory organ is keener than mine to detect an odour, it is also more discriminating to analyze its nature, and his better memory of scents enables him to draw more accurate comparisons than I can.

Although Dr. Dixey's endeavours to preserve scents have met with some success, it nevertheless remains true that the greater part of the evidence for their existence takes this form: "On such and such an occasion, I, A.B., examined such and such a butterfly, and detected an odour, which seemed to me at the time to resemble such and such an odour, with which I was more or less familiar."

Under these circumstances it is obviously desirable that we should have more investigators, more witnesses.

At this stage of the investigation it seems well to bring together all the evidence, in brief, arranged systematically as the insects stand in our cabinets. Wherever I am not personally responsible, in whole or in part, for the statements made, I have placed the paragraph in square brackets [ ]. This does not, of course, suggest that such observations are inferior in value to the others, but avoids the constant repetition of the observer's name.

During the last few years, it has been my privilege to have somewhat unusual opportunities of pursuing this matter, so I venture to offer some suggestions as to the *modus operandi.*

Observations may be made in the field, if there be not too much wind; but better results are often obtained indoors; it is, however, essential that these should be made before the insects become stiff. I find it best to take up the insect with forceps in such a way that by gentle pressure on the sides of the thorax the wings may be made to open, so that the nose may be brought quite close to their upper surface. A gentle inhalation gives better results than a sniff. If no scent be detected, it is well to *exhale* gently on to the butterfly's wings, and then try again. If after repeating this three or four times no result is obtained, a camel's-hair pencil (which must be clean) may be applied to the brands, tufts, or other special structures.

[1] Dixey, *Proc. Ent. Soc. Lond.*, 1905, pp. liv.–lix.; also *ibid.*, 1906, pp. ii.–vii.

I think it well to note whether the result is obtained in the field, or in the house, and in the latter case whether the insect was alive or dead. My practice is to examine in the house every specimen captured, but I fear that too often the examination has been very hasty, not to say perfunctory.

A final warning. Beware of faecal odours due to pinching the butterfly. Again, a "mousy odour" is in several cases recorded; this is not confined to one sex, and is met with in butterflies belonging to various families, but only *after death*. This I believe to be a product of decomposition of either the animal juices or the faeces. The odour resembles that of acetamide, and not improbably may be due to that substance, or some compound ammonia.

Mr. F. R. D. Onslow has suggested that butterflies might conceivably derive their scents from direct contact with flowers. Without denying the possibility of this I can only say, after somewhat extensive experience, that tbe explanation does not fit the facts. It has, however, occurred to me as possible that occasionally the scent might be derived from the opposite sex.

It may be added that I am at one with Fritz Müller and Dr. Dixey in dividing the scents of butterflies into two categories: (1) Attractive scents; in the very large majority of cases confined to the male sex; and (2) Repulsive or protective scents, usually common to both sexes, and often stronger in the female.

There are indeed a few notable exceptions, but so far as the facts are available, it would appear that, speaking generally, the *Pierinae*, *Satyrinae*, and *Lycaenidae* yield scents belonging to the first class (attractive), whereas the *Danainae*, *Acraeinae* and *Heliconiinae* produce repulsive scents. The *Ithomiinae*, *Nymphalinae* and *Papilioninae* contribute scents of both classes. Of other groups little or nothing is known as regards scents.

It is quite certain that in some butterflies two quite distinct scents may be detected in the same individual, one transient, the other more persistent: it is not improbable that herein may be found the explanation of some apparent exceptions, or discrepancies.

Dr. Dixey has called attention to the somewhat surprising fact that (with a few possible exceptions) the scents that are believed to be attractive to the opposite sex are agreeable to the average human perception, whereas those that are believed to be repulsive (and therefore protective) are for the most part disagreeable, or even disgusting.

NYMPHALIDAE.

ITHOMIINAE.

[*Dircenna xantho*, Feld. (*lenea*, Cram.). (Brazil, 1876, 1878).[1] Fritz Müller records a rather strong, most agreeable, vanilla scent in the male.]

[*Ceratinia eupompe*, Hübn. (Brazil, 1878). Fritz Müller records a rather faint scent in the male.]

[*Mechanitis lysimnia*, Fabr. (*polymnia*, Linn.). (Brazil, 1878). Fritz Müller records a very faint scent in the male.]

[*Thyridia megisto*, Feld. (Brazil, 1878). Fritz Müller records an odour in both sexes, but much fainter in the female.]

[*Ithomia sylvo*, Hübn. (Brazil, 1878). Fritz Müller records a rather faint odour in the male.

He seems to claim a scent for the whole group of Ithomiines: "The males have a tuft or pencil of long hairs near the anterior margin of the hind-wings, which in all our Brazilian species emits a more or less distinct odour."]

Tithorea megara, Godart. (Trinidad, 1907). Three males had a very distinct, or even strong, scent, which was compared by both Mrs. Longstaff and myself to *Stephanotis*, but I thought that it had in addition a spicy, or dusty element. A female was scentless.

Athesis clearista, Doubl. (Venezuela, 1907). A male had a slight sweet flowery scent, both alive and dead: it appeared to be associated with the brushes on the hind-wings.

Leucothyris victorina, Hew., and *L. phemonoë*, Doubl. (Venezuela, 1907). A male of each of these species had an offensive odour, which in the latter seemed to be associated with the tufts or brushes on the hind-wings.

DANAINAE.

Danaida chrysippus, Linn. (India, 1904; South Africa, 1905; Ceylon, 1908; Egypt, 1909). There is no doubt whatever, that, to use Dr. Dixey's words: "The scent in both sexes" is "of a strong and disagreeable nature, like that of cockroaches, often stronger in the female." It has also been compared to the odour of musk-rats. It appears to me that the odour is *not* connected with the glands on the hind-wings of the male.

Danaida archippus, Fabr. (*plexippus*, *auct.*, *nec* Linn., *erippus*,

[1] The date given to all Fritz Müller's notes is 1878. His paper was read in June of that year. He speaks of "two years ago," and implies that the observations have been made since. From this one may infer a date of 1876, 1877, or 1878. Where the scent of the butterfly had been mentioned in Fritz Müller's earlier paper the date 1876 is also given.

Cram.). [Fritz Müller (Brazil, 1878) spoke of a rather disagreeable odour "extremely strong in *Lycorea* sp. and *Ituna ilione*, less so in *D. gilippus*, and rather faint in *D. erippus*." It is not quite clear whether he confines this odour to the male sex, but it may be fairly inferred from the context that he does so.]

(Jamaica, Tobago, Panama, Venezuela, 1907). 15 ♂, 2 ♀. All had a scent, similar in quality and intensity in both sexes; it is described in my notes as slight, moderate, or strong, and is compared to that of a cockroach, a musk-rat, a rabbit-hutch, or musty dung; twice it is qualified as "scarcely unpleasant," and "scarcely disagreeable." (Australia, 1910). 1 ♂, 3 ♀. A strong musk-rat scent when alive.

Danaida plexippus, Linn. (*genutia*, Cram.). In India in 1903–4, I sometimes detected an unpleasant scent in this species, but did not record the sex of the specimens examined. On other occasions the results were negative, and it seems probable that in this species the odour is not very strong.

(Mátherán, Bombay Presidency, 1908). A male had a slight musk-rat odour in the field, none at home though still alive.

Danaida jamaicensis, Bates. (Jamaica, 1907). 2 ♂, 2 ♀. Of the two males the scent is described respectively as "strong rabbit-hutch odour," and "decided odour, (?) cockroach, scarcely disagreeable." Of the females it is noted "both with a strong cockroach smell, perceptible next day: my wife, however, described the odour as slightly fusty."

Danaida eresimus, Cram. (Colombia, Venezuela, 1907). Of two males it is noted "(?) very slight pleasant scent"; of a female "strong (?) musk-rat odour when alive."

[N.B.—These last two are probably forms of *D. gilippus*, a butterfly observed by Fritz Müller.]

Tirumala limniace, Cram. (India, 1904). I detected in a male a very faint scent, suggesting old cigar-boxes. Observations made on other occasions were doubtful or negative.

Tirumala septentrionis, Butl. (Ceylon, 1908). 11 males were examined, 9 of them yielded a scent, noted as slight, moderate, or decided, and described as pleasant or sweet, and in two cases compared (with, however, some hesitation) to clover. In four individuals the genital tufts were displayed; certainly in one of these no scent was perceptible (though subsequently detected in the house). In another instance it is noted that the scent was not connected with the sexual pouch on the hind-wing.

Seven females were examined: in six the result was negative or

doubtful; in the other a slight scent was found and compared in the field to *Stephanotis*, but Mrs. Longstaff in the house said "(?) ginger."

The late Col. Bingham said, "The *Danainae* have without exception developed what to our senses, at any rate, is an acrid disagreeable odour and taste accompanied with a tough leathery consistency of body, that to a certain extent protects them from insectivorous enemies."[1] This species is exceptional among Danaines, having a decidedly agreeable scent, stronger in the male.

Chittira fumata, Butl. (*taprobana*, Feld.). (Ceylon, 1908). Out of four males and four females a scent was noted in two of the latter only, described in the field as "a slight musty scent," but on re-examination in the hotel compared to stale tobacco-smoke. In 1904 the results obtained were more positive—"it has the acetylene odour of *Crastia core*, but not so strong and with a difference."[2]

Parantica aglea, Cram. (*ceylanica*, Feld.). (Ceylon, 1908). A distinct scent was detected in fifteen males out of seventeen, and in eleven females out of fourteen. In the male the scent varied from very slight to strong, twice indeed it was so strong as to be clearly perceptible when the insect was fluttering in the net. In quality it was in thirteen examples compared to acetylene (it being specially noted in one instance as "*not Hamamelis*"); in the other two specimens it is described as "acetylene *plus* cockroach," but these, when re-examined in the house, were described as "cockroach only" and "slightly musty" respectively. In six specimens in which there was a decided, or even strong, scent in the field, none was detected in the house; in others the scent at home was slighter, or described as "musty," but in one specimen it was compared to sweet hay. In all the eleven females the scent is compared to acetylene, with the remark in one instance "not so pungent as *Euploea asela*." Two other female specimens were said to have a musty odour.

I am satisfied that in *P. aglea* the scent is more transitory, possibly more volatile, than in the majority of scent-yielding butterflies.

At Kandy in 1904, I had noted of this species: "I was surprised to find that a male, when fluttering in the net, gave out a strong scent like that of *Crastia core*, *i.e.* very like acetylene."

Amauris albimaculata, Butl. (S. Africa, 1905). Dr. Dixey and the author were at one as to both sexes of this insect yielding a similar smell of musty straw, accompanied by an evanescent sharp or pungent scent like that of vinegar.

[1] "Fauna of British India: Butterflies," 1905, vol. i. p. 2.

[2] See above, p. 118.

[*Amauris echeria*, Boisd. (S. Africa). In this distinct, but closely allied species, Mr. G. A. K. Marshall found a strong smell which reminded him somewhat of that emitted by many Ladybirds.]

Euploea (*Crastia*) *core*, Cram. (India, 1903–4). A male had a faint scent that suggested to me rancid oil, or old lamps. Mr. Edwin Scott compared the strong scent of a male to acetylene.[1] At that time I thought the scent was connected with the anal tufts. At MÁTHERÁN, 1908, I confirmed this scent in three males and two females; in one of the latter it is described as "musk-rat + acetylene," but in two specimens I noted the scent (when examined in the house) as like that of acetic acid, although in the same specimens I had in the field noted the odour of acetylene. Doubtless the scent has two elements, one more persistent than the other. One male was noted as emitting no scent though the tufts were everted.

Euploea (*Crastia*) *asela*, Moore. (Ceylon, 1908). In thirty-two out of thirty-eight males and in seventeen out of nineteen females examined a scent was noted in the field. In four males and one female my notes record that no scent was detected, as regards the others they are silent. Again, it is clearly recorded that on re-examination in the hotel in thirteen males and five females no scent could be detected, moreover when a scent *was* noted at home it was in the large majority of specimens (especially among males) much fainter than it had been in the field.

In both sexes the scent varied considerably in strength: it was, I think, quite as strong in the females as in the males, though certainly the three specimens in which the scent was strong enough to be obvious through the net were all males. In one male the scent was described as not unpleasant; in five examples—one male, four females—it is described as pungent and compared to acetic acid. To one female the note is: "strong pungent odour, acetic acid: distinct at home, still pungent (insect alive). The scent adhered to the fingers after pinching."

As with *Parantica* the scent of *Crastia* would appear to be more volatile than in the *Pierinae* or in *Danaida*.

Having abundant material I made some endeavour to ascertain the source of the scent. Fifteen times it is noted that the male genital tufts were fully everted when the insect was examined, nevertheless in five no scent could be detected, although in the others it was more or less strong. There is a special note to one specimen: "the acetylene odour seemed to come from the tufts," but,

[1] See above, pp. 95, 96.

on the other hand, in four cases it is noted that the scent appeared to come from the wings, in one of these from their upper surface.

I then tried the effect of rapid dismemberment immediately after pinching:—

(*a*) A male seen on the wing with tufts displayed. It was caught, pinched and the abdomen amputated. The abdomen yielded no scent, but what I may term the *torso* had a slight acetylene scent, which appeared to come from the wings.

(*b*) A male with the tufts displayed: the amputated abdomen yielded no scent, but the wings a moderate acetylene scent.

(*c*) A male with the acetylene scent: amputation proved that it was certainly not connected with the abdomen.

(*d*) A male was dismembered: the scent appeared to come from the thorax.

(*e*) A female with pungent odour was dismembered: the scent appeared to originate in the thorax.

(*f*) A female was dismembered: the scent appeared to come from either the thorax or the base of the wings.

From these facts I am forced to the conclusion that in *Crastia* and in *Tirumala* the scent—which moreover is common to both sexes—whatever its source may be, is independent of the genital tufts which form such a conspicuous feature. This conclusion is contrary to my first impression—and certainly contrary to the impressions of such an experienced collector as Commander J. J. Walker, R.N.

Euploea (*Crastia*) *amymone*, Godart, f. *kinbergi*, Wallgr. (China, 1904). The acetylene scent was noted in several males, once it was so strong as to be obvious as soon as the insect was in the net.

Euploea (*Trepsichrois*) *midamus*, Linn. (*superba*, Herbst.). (China, 1904). The acetylene odour of a female was perceptible when it was in the net.

[*Euploea* (*Trepsichrois*) *mulciber*, Cram. (Borneo, 1903). Mr. Shelford found the eversible tufts in the male to be sweetly scented.] [1]

Euploea (*Pademma, Salpinx*) *kollari*, Feld. (Calcutta, 1903). A single male had a slight, peculiar, rather disagreeable scent.

Euploea (*Salpinx*) *sinhala*, Moore, considered by Bingham to be a local race of the preceding. (Ceylon, 1908). Two males were examined with the following results:—

(*a*) Acetylene odour, moderate in the field, slight at home. (*b*) Moderate acetylene scent in the field, none in the house. It

[1] R. Shelford, *in litt.*

was alive; on pinching it again the tufts were protruded and there was a momentary strong acetylene scent. Of course it does not necessarily follow that the scent emanated from the tufts.

Euploea (*Narmada*) *montana*, Feld. (Ceylon, 1908). Five males all had a strong, or at any rate decided, acetylene odour in the field; at home either no scent at all, or at most a faint musty odour. In one case the strong acetylene odour seemed to come from the upper surface of the body or wings, while there was a suspicion of a sweet scent (compared with some hesitation to sassafras) which seemed to come from the tufts. Two living females yielded an odour of acetic acid, which in one persisted slightly after death.

[*Euploea* (*Danisepa*) *rhadamanthus*, Fabr. (Assam, 1881). Of this species Wood-Mason says: "the eversible caudal rosettes of the males are finely vanilla-scented."]

SATYRINAE.

[*Antirrhaea archaea*, Hübn. (Brazil, 1878). Fritz Müller says the male emits a strong odour.]

Satyrus semele, Linn. (England, 1903, 1904). Dr. Dixey and I are agreed that the male has a slight scent; he compares it to that of chocolate or sandalwood; to me it rather suggests snuff, or an old cigar box.

Epinephele janira, Linn. (*jurtina*, Linn.). (England, 1904). Dr. Dixey and I both think that the male had a very slight odour; to me it appears somewhat pungent, and suggests old cigar boxes.

Pararge megaera, Linn. (England, 1904, 1908). Dr. Dixey detects in the male "a faint, but heavy, sweet odour suggestive of chocolate cream"; he connects it with the brand on the fore-wing. In a few specimens out of many I detected a slight odour of chocolate (*not* of vanilla), but am unable to connect it with the brand. Experience with this species makes me feel quite certain that Dr. Dixey's nose serves him better than mine does me.

Pararge schakra, Koll. (India, 1903). I suspected the existence of a very slight sweet scent, that appeared to be unlike that of any other species examined up to that time.

Melanargia galathea, Linn. (England, 1906). Two males had a slight but distinct musky scent.

Mycalesis safitza, Hew. (S. Africa, 1905). Dr. Dixey found in the tufts of the male of this butterfly a very strong odour of chocolate. I noted a similar scent, but not especially strong.

Mycalesis perspicua, Trim. (S. Africa, 1905). Dr. Dixey and I agreed that there was a strong odour in this butterfly, distinct from

that of the last, but we were in only partial agreement as to its character. However, we had but two specimens available.

Mycalesis mineus, Linn., f. *polydecta*, Cram. (Ceylon, 1908). In two males exposure of the pencils of hairs on the hind-wings produced a strong scent, which I compared to burnt sugar, my wife to coarse brown sugar, or treacle.

[*Mycalesis suaveolens*, W.-M. & de N. (Assam, 1881). Wood-Mason notes: "The scent-glands and fans . . . emitted a powerful and delicious odour resembling that of vanilla for some hours after the death of the insect."]

[*Lethe rohria*, Fabr. (Assam, 1881). Wood-Mason notes: "The males of this species emit a delicious vanilla-like scent.]

Yphthima ceylonica, Hew. (Ceylon, 1908). In a few males of this abundant species a very slight scent of chocolate was detected.

Calisto zangis, Fabr. (Jamaica, 1907). In ten males, nearly all those examined, there was a scent varying from faint to strong, compared to treacle, chocolate, burnt sugar, or caramel, but in one instance described simply as aromatic. The male of this species has a very conspicuous brand. Ten females were without scent.

Heteronympha merope, Fabr. (Tasmania, Australia, 1910). This butterfly is remarkable for the striking difference between the sexes, the males are much the larger and handsomer insects. I found in four males a faint but distinct scent, of a sweetish character, sometimes suggesting treacle, sometimes tobacco. In eight *females* I found a decided scent, sweet and flowery. My wife said, "sweetish, like some flower, not quite 'Syringa,' not so strong." I once compared it to *Philadelphus*,[1] but in two other specimens it seemed to me to have rather a balsamic character. I do not recall any other butterfly in which the female has a sweet flowery scent stronger than that of the male.

ELYMNIINAE.

[*Elymnias undularis*, Drury. (Assam, 1881). Wood-Mason noted that the males emit a strong odour resembling vanilla, the females being scentless.]

Elymnias fraterna, Butl., considered by Bingham to be an insular race of the preceding. (Ceylon, 1908). Four males had an odour like that of vanilla-scented chocolate: once Mrs. Longstaff compared it to very strong honey, or coarse brown sugar.

[1] The Mock-orange, *Philadelphus coronarius* [Nat. Ord. *Saxifragaceae*], is commonly called "Syringa," a name more properly given to the Lilac, *Syringa persica* [Nat. Ord. *Oleaceae*].

MORPHINAE.

[*Thaumantis diores*, Doubl. (Assam, 1881). Wood-Mason notes that the scent-fans of the male are vanilla-scented.]

[*Stichophthalma camadeva*, Westw. (Assam, 1881). Wood-Mason notes: "The gland, covered by a patch of modified scales, and by an erectile wisp of hairs on each hind-wing in the male, secretes a fluid that gives out a pleasant odour distinct from, but so faint as barely to be perceptible in the presence of, a much stronger odour (resembling that of sable fresh from the furrier's shop), which is common to the two sexes."]

[*Morpho hercules*, Dalm.; *M. epistrophis*, Hübn.; *M. menelaus*, Linn.; *M. achilles*, Linn.; *M. adonis*, Cram.; and *M. cytheris*, Godart. (Brazil, 1878). Fritz Müller recorded that the males of all these butterflies produced a very distinct odour, which in the last two species was most agreeable, resembling vanilla.]

BRASSOLINAE.

[Fritz Müller (Brazil, 1878) noted very distinct odours in the males of various species of *Caligo*, *Opsiphanes* and *Dasyophthalma*, the odour being particularly strong in the latter.]

NYMPHALINAE.

[*Myscelia orsis*, Drury. (Brazil, 1878). Fritz Müller observed an unusually strong odour in the males of this species, as well as in those of the next following.]

[*Epicalia acontius*, Linn. (Brazil, 1878).]

[*Ageronia arethusa*, Cram. (Brazil, 1878). Fritz Müller noted a rather strong odour in the male.]

[*Didonis biblis*, Fabr. (Brazil, 1878). Fritz Müller noted in 1876 that the male had a pleasant odour like heliotrope, the female an unpleasant smell; in 1878 he wrote: "so far as odours are concerned [this is] the most interesting of all butterflies that I know." There is a strong disagreeable odour common to both sexes. The males have *in addition* two other scents comparable to heliotrope and musk respectively; the latter faint.]

I much regret that in the specimens of this handsome, and very conspicuous butterfly, which passed through my hands during the winter of 1906–7, I did not notice any scent.

[*Prepona laertes*, Hübn. (Brazil, 1878). Fritz Müller noted a distinct odour in the male. In 1876 he had described this as "a not strong but unmistakable odour, like a bat."]

Byblia goetzius, Herbst. (S. Africa, 1905). Dr. Dixey found in the males a very distinct and agreeable odour of sweet chocolate with a suggestion of vanilla. I found a similar scent in the only

specimen that I examined—a female. If the latter observation be correct it is remarkable.

Charaxes varanes, Cram. (S. Africa, 1905). Dr. Dixey's[1] words are: "A ♂, on being squeezed, emitted an odourless juice. Another was noted by Dr. Longstaff as having a 'treacly' odour. A female was thought by him to have a smell like cow-dung. To me the scent of the same specimen recalled that of *Danaida chrysippus*." These results are not concordant; however, the observations were few in number.

Salamis anacardii, Linn. (S. Africa, 1905). Both sexes have an animal-like odour, suggesting to me rabbit-hutches; it appears to be stronger in the female.

Neptis agatha, Cram. (S. Africa, 1905). Dr. Dixey noted in three males from Natal, a strong and very disagreeable scent, like that of *D. chrysippus*, but more intense. Two male specimens which I took on the Zambesi had a slight scent, which I described as sweet. There is, moreover, according to Dr. Dixey, a difference in the aspect of these insects from the two localities.

Neptis jumba, Moore. (Ceylon, 1908). A faint sweet chocolate scent was detected in a male in the house. A somewhat similar scent was suspected in another male and in a female. On the other hand, no scent was recognized in the much commoner *N. varmona*, Moore.

[*Hypolimnas misippus*, Linn. (S. Africa, 1905). Dr. Dixey detected in a male a smell like coffee, not very strong.]

Hamanumida daedalus, Fabr. (S. Africa, 1905). Dr. Dixey and I agree that the male has a smell of the burnt sugar type.

Precis clelia, Cram. (S. Africa, 1905). I detected a treacly scent in a male.

Precis iphita, Cram. (Ceylon, 1908). Two males out of several examined yielded a slight treacly odour.

Precis almana, Linn. (Máatherán, India, 1908). A male had a slight sugary scent.

Cynthia asela, Moore. (Ceylon, 1908). Five males out of eight had a peculiar, slight, sweet scent, compared at the time to sassafras, or to French-polish.

Victorina steleness, Linn. (Jamaica, 1907). Five males appeared to have a slight flowery scent; in one it suggested Chrysanthemum.

Colaenis cillene, Cram. (Jamaica, 1907). In eight males out of eleven examined there was a scent, decided, but never strong. Its character was noted as "peculiar," "sweetish," "pleasant,"

[1] *Proc. Ent. Soc. Lond.*, 1906, p. iv.

"distinctly aromatic," "resinous," "drug-like," or "medicinal"; it suggested to me at one time or another tar, Canada-balsam, and *pure* carbolic acid, but my wife compared it to ginger, or a mixture of ginger with jasmine. It is evident that this scent puzzled me greatly at the time, but subsequent experience with other scents makes me think that sassafras would probably be the best comparison.

Dione vanillae, Linn. (Jamaica, 1907). Of seventeen males examined thirteen exhibited an odour varying from very faint to very strong: in character this was distinctly disagreeable, and I noted it as "unpleasant," "like cow-dung," or "like asses," but more usually as "like a stable." My wife considered it "unpleasant," or "offensive." Mr. Abell thought it "musky."

Dione juno, Cram. (Venezuela, 1907). A single male had a slight stable-like odour.

Heliconiinae.

[Fritz Müller (Brazil, 1878) says that the butterflies of this sub-family possess a disgusting odour, generally stronger in the female sex. Moreover he says that *Colaenis* and *Dione* cannot be separated from *Heliconius* and *Eueides*. He mentioned the occurrence of scents in these genera in his earlier paper, but without details. See Appendix, §§ IX.–XII.]

Eueides aliphera, Godart. (Trinidad, 1907). Three males were examined: two with a negative result; the third was noted as having "a strong *Dione* scent," *i.e.* an odour like that of a stable, or of asses. Two females were also examined; they both had decided odours described respectively as:—"peculiar scent, (?) acetylene; strong when alive," and as "strong *Dione* scent when living; slight flowery scent when dead."

Heliconius euryades, Riff. (Trinidad, 1907). Two males were examined: one had a peculiar, rather pleasant, smell, the other none. Two females were also examined, one with a doubtful result, the other had a slight odour like that of the species next mentioned, but it was only perceptible during life.

Heliconius hydarus, Hew. (Trinidad, Tobago, Venezuela, 1907). Eleven males were examined: three gave a negative result and one was doubtful, but the remaining seven had a scent which varied from very slight to very strong, and was described as musty, like acetylene, or like hazeline (a preparation of Witch-hazel, *Hamamelis virginica*). This last comparison, which struck me as good, is due to Mr. G. H. Sworder of Cocoa Wattie, Tobago, who was familiar with the scent of the butterfly. Eight females were examined, only one with negative

results; in the other seven the scent varied from slight to strong, and was described as "disagreeable," "like acetylene," or "like hazeline." In one male and one female the scent was so strong as to be easily discerned when the butterfly was fluttering in the net.

Five of the above butterflies were captured in Trinidad on April 14th, 1907, and were examined for scent when their enclosing papers were opened at Oxford on May 6th, or three weeks after death. One of them—*H. euryades*, ♀—had none; the others—*H. hydarus*, 3 ♂, 1 ♀—had a slight, but quite decided, scent. Yet, curiously enough, in the case of two of these male *hydarus*, I did not find it possible on the day of capture to be sure that they had any perceptible scent. Finally, when a drawer containing all my black and red *Heliconii* was opened on July 15th, or three months after death, the odour, though faint and evanescent, was distinctly perceptible in spite of the presence of naphthalene.

I have since heard from a professional setter of butterflies, whose name I do not know, that he had often noticed when setting *Heliconii*, that they had a peculiar scent.

Heliconius charithonius, Linn. (Jamaica, 1907). With this species the majority of observations gave negative results, nevertheless in three males and two females a slight pleasant flowery scent was detected. In one example of each sex this was confirmed by my wife, who described the odour as sweet.

ACRAEINAE.

[*Actinote thalia*, Linn. (Brazil, 1878). Fritz Müller noted a disgusting odour in both sexes.]

In 1907 at Carácas I failed to detect any scent in *Actinote antaeas*, Dbl. & H.

[*Planema aganice* Hew. (S. Africa, 1905). Dr. Dixey stated that the green juice exuded from a male specimen had a by no means unpleasant odour like that of a crushed cabbage leaf.]

Acraea alboradiata, Auriv. (S. Africa, 1905). Dr. Dixey and concur in stating that both sexes have a distinct musty odour, like old hay or straw.

Acraea anemosa, Hew. (S. Africa, 1905). Dr. Dixey and I are in substantial agreement. The males have a musty odour, which Dr. Dixey also found in a female. Mr. G. A. K. Marshall says that this is the only *Acraea* in which he has noticed a strong odour.

Acraea encedon, Linn. (S. Africa, 1905). I found a slight unpleasant odour in both sexes.

Acraea doubledayi, Guér. (S. Africa, 1905). Dr. Dixey and I concur as to a musty odour in the male; I found it in the female also.

Acraea atolmis, Westw. (S. Africa, 1905). I found a faint odour in both sexes.

Acraea caldarena, Hew. (S. Africa, 1905). Dr. Dixey found a distinct smell of musty straw in the female; I came across a slighter odour of similar character in a male.

[*Acraea atergatis*, Westw. (S. Africa, 1905). Dr. Dixey found a similar musty odour, accompanied by a strong ammoniacal scent, like that of stable-litter. He does not mention the sex.]

LYCAENIDAE.

Lycaena icarus, Rott. (England, 1904). Both Dr. Dixey and myself have found in the male of the Common Blue a decided scent suggestive of chocolate sweetmeats.

Chrysophanus astrarche, Bergstr. (England, 1908). I found in a male the odour of chocolate, *not* flavoured with vanilla.

Cyaniris singalensis, Feld. (Ceylon, 1908). Six out of eight males had a scent of varying intensity, described in all cases as sweet, once as luscious, and once as *Freesia*-like.

Nacaduba atrata, Horsf. (Ceylon, 1908). Two males had a sweet flowery scent, confirmed by Mrs. Longstaff, and in one case compared by her to "very, very faint jasmine."

Lampides elpis, Godart. (Ceylon, 1908). Five males, all those examined, had a sweet scent, which in one specimen was compared (with some hesitation) to clover.

Lampides lacteata, de Nicév. (Ceylon, 1908). Nine males were examined, all had a distinct smell which was compared to vanilla biscuits, or chocolate sweets.

It is interesting to note that these two closely allied species have quite different scents.

Lampides celeno, Cram. (Ceylon, 1908). A minority of the numerous males examined had a faint sweet scent.

Catochrysops hanno, Stoll. (Jamaica, Trinidad, Tobago, Colombia, Panama, Venezuela, 1907). One male was noted to have a very strong, sweet, *Freesia*-like scent, but most of my specimens of this tiny butterfly appeared to be odourless.

Polyommatus baeticus, Linn. (Ceylon, 1908). About half of the males examined had a slight scent like that of Meadow-sweet.

Tarucus theophrastus, Fabr. (Sûdân, 1909). A male had a moderately strong, sweet, luscious scent.

Polyniphe dumenilii, Godart. (Venezuela, 1907). Ten males of this little black and white butterfly gave positive results of a surprising character. In the majority of cases the odour was strong, or even very strong; moreover it was disagreeable; and I compared

it to horse-urine, but more usually to pig-sties, or, perhaps more correctly, to pigs. At first it seemed scarcely credible that so small a butterfly could smell so strongly. My only female specimen was odourless.

Rapala lazulina, Moore. (Ceylon, 1908). Three males yielded a scent like vanilla biscuits.

Theclopsis tephraeus, Hübn. (Venezuela, 1907). A strong peculiar, rather disagreeable odour was detected in a male of this species.

Tmolus cambes, Godm. & S. (Venezuela, 1907). I noted in a male a treacly smell; my wife compared it to coarse brown sugar.

Tmolus palegon, Cram. (Venezuela, 1907). A male had an odour of chocolate.

[*Thecla atys*, Cram. (Brazil, 1878). Fritz Müller found an unusually strong odour in the male of this species, also more or less distinct odours in various other species the names of which he did not know. In the case of *T. atys* (in 1876) he described the odour as "bat-like."]

PIERINAE.

Catopsilia pyranthe, Linn. (*gnoma*, Fabr.). (Assam, 1880; India, 1904; Ceylon, 1908). Wood-Mason noted that the tufts of hair on the wings of the male smelled like jasmine. I confirmed this in India, but thought that a closer comparison was to *Polianthes tuberosa*. After my second visit to Ceylon, in 1908, I wrote as follows:—

"The number of specimens taken was very much smaller than of *pomona*, but the scent was more easily detected in the male, and more decided in the female than in that species. In both sexes the scent was compared to *Stephanotis*, but in one male to *Freesia*, and in one female, Mrs. Longstaff thought the odour was 'a little bit hair-oily.'"

Catopsilia pomona, Fabr. (*crocale*, Cram., *catilla*, Cram.). (Ceylon, 1904). I detected a slight jasmine-like scent in the male on stroking the "scent tufts" on the hind-wings.

(Ceylon, 1908.) The sweet scent associated with the fringes of the male was confirmed; this I compared to *Freesia*, or *Stephanotis*. Out of twenty-seven females examined the result was negative in eighteen, but in the other nine a slight, usually very slight, sweet scent without other special character was noted.

Catopsilia florella, Fabr. (S. Africa, 1905). On exposure of the tufts of hair-like scales on the hind-wings a very strong sweet scent is emitted. Dr. Dixey compared it to Jasmine, I to *Polianthes*, or

Freesia. (Sûdân, 1909). The scent in the male was confirmed, a faint odour was suspected in the female.

[*Metura cipris*, Fabr. (Brazil, 1878).

Phoebis argante, Fabr. (Brazil, 1876, 1878).

Rhabdodryas trite, Linn. (Brazil, 1878).

Callidryas eubule, Linn. (Brazil, 1878).

Fritz Müller perceived a musk-like odour in the males of the above four species; it was unusually strong in *cipris*, very distinct in *argante*, faint in *trite* and *eubule*. In the females of *argante* and *eubule* he found a very strong peculiar odour, in which some volatile acid seemed to predominate.] I give my results:—

Phoebis agarithe, Boisd. (Tobago, 1907). Of three males examined, two yielded a scent noted as being "sweet, neither strong nor pleasant."

Callidryas eubule, Linn. (West Indies, Northern Coast of S. America, 1907). In no less than thirty-two out of the thirty-three males tested a distinct scent was readily perceived, indeed in the great majority of cases it is noted as strong, twice as very strong. In quality the scent was agreeable (Mr. Abell termed it delicious) and was compared by me to *Stephanotis*, or *Freesia*, but Fritz Müller had termed it musk-like; and Miss Murtfeldt had spoken of it as "a slight violet odour."[1] With the twenty-two females examined the result was very different; in nine it was negative, but in the remaining thirteen a scent was detected, which, though usually described as very slight, or slight, and never as strong, was often distinct enough. In quality the scent of the female *eubule* was disagreeable; somewhat sweet, but recalling bad pomade, or rancid butter, or butyric acid (as Dr. Dixey aptly suggested of another butterfly).

Gonepteryx rhamni, Linn. (Algeria, 1905). *Gonepteryx cleopatra*, Linn. (Algeria, 1905). I give my observations on the scents in these butterflies in full, as originally published.[2]

"At Hammam Meskutine, Algeria, on March 15th, 1905, while examining my captures towards the close of the day prior to writing the data on their envelopes, I was struck with the sweet scent of a male *Gonepteryx cleopatra*, Linn. All the three dead specimens which I had taken that day had the scent, but in two it was faint. On March 19th, at Bougie, I confirmed this in a living specimen, describing the scent at the time as "sweet, rich, thick—suggesting *Freesia*."

[1] Scudder, "Butterflies of the Eastern United States," vol. ii. p. 1047.

[2] *Proc. Ent. Soc. Lond.*, 1905, pp. xxxv., xxxvi.

"At Hammam R'ihra I submitted living male *cleopatra* to four ladies; one could not detect the scent, another could not describe it, a third compared it to Primrose, the fourth compared it first to Gorse, then to faint 'Syringa' (meaning *Philadelphus coronarius*). Personally after more experience I hesitate between *Freesia* and *Philadelphus*. Altogether up to March 31st, when it was getting over, I examined nineteen male *G. cleopatra* and found the scent quite distinct in all save one.

"Though not as abundant in Algeria as *G. cleopatra*, our more familiar *G. rhamni* is sufficiently common, and naturally I examined that species, or form, for scent. To my great surprise out of ten specimens examined not one had a scent at all like that of *cleopatra*, indeed in most of them I could detect no scent whatever! One day in the hotel garden at Hammam R'ihra, I caught within a space a few yards in extent, and within a quarter of an hour, five butterflies in the following order:—1 ♂ *rhamni*, 3 ♂ *cleopatra*, 1 ♂ *rhamni*; all the three *cleopatra* had the scent, but neither of the *rhamni*.

"The one specimen of *cleopatra* in which no scent was detected was tested on a day when my nasal mucous membrane was somewhat inflamed, moreover a neighbouring pig-sty was distinctly a disturbing element. For these reasons I do not include in the above numbers 2 ♂ *rhamni* examined under the same conditions with negative results.

"The living *Gonepteryx* can be easily held by the thumb below and the forefinger above the thorax, the wings being expanded, and so examined without appreciable injury to the specimen, in a way that the more delicate structure of most butterflies renders impossible.

"These surprising results struck me so much at the time that I took care to assure myself that I was not deceived, but I trust other entomologists will repeat the observations when opportunity offers. Such a difference in the scent of the two forms must imply a physiological difference that would point to a specific distinction.

"In North Devon on the 29th of May, 1905, I examined a ♂ *G. rhamni* but could detect no scent."

In the discussion which followed, Dr. F. A. Dixey said:—

"The facts relating to the scent of *Gonepteryx cleopatra* and *G. rhamni* which have just been laid before us by Dr. Longstaff are of very great interest, and certainly point in the direction of a real distinction between the two forms. I have occasionally detected a slight scent in British specimens of *G. rhamni* ♂, as recorded in our

'Proceedings' for 1904, p. lviii, but nothing like what Dr. Longstaff describes in *G. cleopatra*."

[*Colias edusa, auct.* (England, 1900). Dr. Dixey determined the existence in the male of an odour which he compared to Heliotrope.[1]] In Algeria I failed to detect any scent in *C. edusa*.

Colias electra, Linn. (S. Africa, 1905). Dr. Dixey found in a male a scent like that which he had previously found in *C. edusa*. I found a somewhat less agreeable odour.

Colias nilgiriensis, Feld. (India, 1904). I suspected a slight scent in two males of this species.

Colias hyale, auct., f. *marnoana*, Rogenh. (Sûdân, 1909). I found a very slight scent in both sexes, and doubtfully compared it to chocolate sweets, or to cloves. It is well to add that, according to my experience, it is very difficult to detect scents in the genus *Colias*; the volume of scent, if one may use the expression, seems to be very restricted, requiring the keenest sense for its apprehension. Dr. Dixey informs me that the *hyale* group of *Colias* is without "scent patches."

Terias euterpe, Ménét. (Jamaica, 1907). I had ample opportunities of studying this very common Jamaican butterfly. Of twenty-one females taken not one was scented, but thirty-one out of thirty-nine males indubitably were. Their odour varied from "very slight" to "strong" (seventeen specimens); my wife described it on various occasions as a slight pleasant smell," "strong, like Syringa," "a very soft gentle smell, might be Jasmine," and "very slight, sweet, Jasmine or Syringa." Mr. A. P. Ponsonby, when out with me one day, suggested Gorse. To my own judgment the scent resembled rather Clove-pink, but was still more like Pink Bind-weed (*Convolvulus arvensis*, Linn.).

Terias delia, Cram. (Jamaica, Panama, Colombia, Venezuela, 1907), and *T. phiale*, Cram. (Venezuela, 1907). Results conflicting, but in the large majority of cases negative.

Terias albula, Cram. (Trinidad, Tobago, Colombia, Venezuela, 1907). Results uniformly negative.

Terias nise, Cram. (Trinidad, Tobago, Panama, Venezuela, 1907). Out of eight males taken five had a scent, varying from very slight to very strong; it was compared to that of Pink Bind-weed. A slight scent was detected in a female specimen; this was confirmed by Mrs. Longstaff.

Terias messalina, Fabr. (Jamaica, 1907). In six males out of ten a scent was noted; it is described in my notes as distinct or

[1] *Proc. Ent. Soc. Lond.*, 1904, p. lvii.

strong, and compared to Pink Bind-weed and to spice. It is also noted as "distinct from that of *euterpe*, more dusty, less specific," but another specimen "more spicy than Bind-weed."

Terias westwoodii, Boisd. (Jamaica, 1907). Only three males were taken; all had a scent, described in one example as "spice odour, not quite the same as *euterpe*."

Terias libythea, Fabr. (Ceylon, 1908). In several male specimens —at least five—a faint scent was detected, which I compared to that of *Convolvulus arvensis*.

Terias hecabe, Linn. (India, &c., 1903–4, Ceylon, 1908). I failed to detect any scent in this common *Terias* or any of its allied forms.

[*Leptalis thermesia*, Godart. (Brazil, 1878). Fritz Müller says that the male emits a very strong odour disagreeable to human noses.]

[*Leptalis astynome*, Dalm. (Brazil, 1878). Fritz Müller found a similar but much fainter odour, in the male of this species.]

Leptalis (*Enantia*) *melite*, Linn. (Brazil, 1878). Fritz Müller found in this species also that the male had a faint disagreeable odour. My experience was different, the only specimen that I took (Venezuela, 1907) had a scent like Mignonette.

Meganostoma cerbera, Feld. (Venezuela, 1907). One out of three females taken is noted as having had "a slight, very sweet scent; (?) clover."

Ixias cingalensis, Moore. (Ceylon, 1908). The nine males examined all had a sweet, but only moderately strong scent, which reminded me of Meadow-sweet. Four females were scentless.

Hebomoia australis, Butl. (Ceylon, 1908). Nine males, all those examined, had a heavy sweet scent, in most of them strong, in all decided: my wife and I compared it to the flowers of Mango, or to Cinnamon. In three females out of four there was a similar scent.

[*Teracolus ione*, Godart. (S. Africa, 1905). Dr. Dixey found the scent of the male not always easy to detect, but sweet and flowery.]

Teracolus protomedia, Klug. (Sûdân, 1909). The male has a distinct, scarcely agreeable scent, hard to describe.

Teracolus annae, Wallgr. (S. Africa, 1905). Dr. Dixey sometimes found the scent of the male strong like "Syringa" (*Philadelphus*). I found it faint and like that of *Ganoris brassicae*.

Teracolus halimede, Klug. (Sûdân, 1909). A dead male had a somewhat disagreeable odour.

Teracolus phisadia, Godart. (Sûdân, 1909). A dead male had a sweet, luscious scent.

Teracolus daira, Klug. (Sûdân, 1909). A *female* had a scent like Clove-pink, both in the field and in the house.

Teracolus omphale, Godart. (S. Africa, 1905). Both Dr. Dixey and I found in the males a "white-flower perfume," but the former usually found a musky constituent in addition.

[*Teracolus achine*, Cram. (S. Africa, 1905). Dr. Dixey found in the males an odour like that of Honeysuckle.]

Teracolus auxo, Lucas. (S. Africa, 1905). We both found a sweet scent in the males, which appeared to my companion to be "heavier" than it did to me.

Teracolus eris, Klug. (S. Africa, 1905). Each of us found a male with a distinct flowery scent.

Nepheronia ceylanica, Feld. (Ceylon, 1908). The male of this beautiful butterfly has a more or less distinct scent, which I compared to *Freesia*. A female had a similar scent, though slight, which my wife compared to Frangipani.

Nepheronia hippia, Fabr. (Mátherán, India, 1908). A fine male had a very slight burnt-sugar scent.

Eronia cleodora, Hübn. (S. Africa, 1905). Both Dr. Dixey and I found a flowery scent in the males, but, as in so many cases, my friend's conclusions were somewhat more positive than mine.

Euchloë cardamines, Linn. (England, 1905, 1906). In a few males out of many tested, I have found a fairly distinct, though faint scent, sometimes described as musky, once as *very* sweet.

Daptonoura lycimnia, Cram. (Venezuela, Trinidad, 1907). The three males taken all had a strong, sweet, flowery scent, suggesting *Freesia*. Of three females one bears the note "rich sweet scent." There is no doubt whatever about the sex of the individual, neither can I suggest by way of explanation that the note really applies to another individual. This is perhaps the most marked of a very few exceptional cases in which a strong agreeable scent has been observed by me in a female Pierine; for some time my own view was that in each such instance I had been deceived—possibly by a neighbouring flower, or by the scent of another butterfly adhering to fingers or forceps. However, in the case of *D. lycimnia*, Fritz Müller (Brazil, 1878) observed that the female during courting emitted from her genitalia an odour which he described as "rather faint, though quite distinct . . . very different from that emitted by the wings of the male." Fritz Müller found the latter very delicious, but rather faint and often hardly distinguishable.

[*Daptonoura ilaire*, Godart. (Brazil, 1878). Fritz Müller observed

a rather strong odour in the male. In 1876 he had said that the odour was faint.]

Pinacopteryx charina, Boisd. (S. Africa, 1905). Dr. Dixey and I occasionally found a flowery scent in the male of this butterfly; he compared it to Mignonette.

Pinacopteryx pigea, Boisd. (S. Africa, 1905). We both found a distinct, sometimes strong, scent in the male, like Honeysuckle.

Belenois gidica, Godart. (S. Africa, 1905). In some of the males Dr. Dixey and I found a flowery scent, which he compared to that of roses.

Belenois mesentina, Cram. (India, 1904). The male was found to have a faint, sweet, flowery scent which did not appear to me to be quite like that of any other insect. (S. Africa, 1905). Dr. Dixey found in a male a scent much like that of *B. gidica*. (Sûdân, 1909). Males were found by me to have a slight scent, sometimes described as musky, but once as luscious.

Belenois severina, Cram. (S. Africa, 1905). Both Dr. Dixey and I found much individual variation in the males. He compared their scent to sweet-briar; I thought it like that of *G. brassicae*, but stronger and more luscious.

Belenois thysa, Hopff. (S. Africa, 1905). We agreed that the males had a strong, distinct odour. Dr. Dixey compared it to that of roses, I rather to Bluebell (*Scilla nutans*), but sometimes to *Freesia*.

Belenois teutonia, Fabr. (Australia, 1910). A slight scent was suspected by me in sundry males, but nothing at all definite.

Delias eucharis, Drury. In India during the winter of 1903–4 I observed the scent of this species and compared it to that of *Ganoris rapae*, or sweet-briar. On that occasion I made sure of the scent in the male, and more than suspected its presence in the female.

My more recent experience (Ceylon, 1908) enables me to speak with greater confidence. Of eighteen males examined a scent was detected in seventeen; in four of these the scent was very slight, or indefinable, but in twelve it was strong, or very strong, and compared to that of sweet-briar. Out of nine females examined in three no scent could be detected, but in six specimens there was more or less scent, but in no case was it strong; this was described as "sweet," "dusty or musky," and "faint sweet-briar." Mrs. Longstaff said of the last specimen "very slight lemon-verbena; yes, perhaps more like sweet-briar"; but of another specimen she said, "it has a little gentle sort of smell, (?) ginger, or (?) coarse brown sugar."

[*Delias hierte*, Hübn., var. *indica*, Wallgr. (Cachar, 1881). Wood-Mason noted that *both* sexes have a strong, grateful musk odour.]

Delias nigrina, Fabr. (Australia, 1910). A male was thought by me to have a very slight scent.

Leptophobia aripa, Boisd. (Venezuela, 1907). Seven males out of eight examined had a distinct or even strong scent, which I compared on various occasions to Orange, *Freesia*, and Mignonette.

Pieris calydonia, Boisd. (Venezuela, 1907). Three males of this species—all that I captured—had a distinct flowery scent, in one described as "like that of *G. brassicae*," in another as "somewhat sickly."

Pieris (*Perrhybris*) sp.—apparently undescribed—near *sevata*, Feld. (Venezuela, 1907). The only specimen taken, a male, had a "faint, sweet, flowery scent" (see above, p. 320).

Catophaga paulina, Cram. (Ceylon, 1904, 1908). The results of my 1904 observations were only in part confirmed. In both years the scent was noted in the male only; in 1904 it was described as "like sweet-briar, but sweeter and more luscious," whereas in 1908 it was variously described as "sweet," "very sweet, (?) *Freesia*," "flowery," "decided Meadow-sweet," "decided *Stephanotis*," "extremely sweet."

Huphina nerissa, Fabr. (India, 1904; Ceylon, 1908). The results of many observations were concordant; the males have a distinct sweet-briar scent.

Ganoris napi, Linn. Of this species it is sufficient to say that its pleasant and very distinct scent is perhaps the best known of all, as it is the easiest to detect. Though very like the scent of Lemon Verbena, it is not identical with it. Out of forty-six male specimens examined at Mortehoe one summer the scent was present in all, but it was not present in any one of thirty-five females examined, though I am disposed to think that the female has a very faint scent more like that of *G. rapae*.

Many times I have known by the scent alone, the moment that I have got it into my net, that a small White was a male *napi*. There are but two other butterflies in which I have found the Lemon Verbena scent: they are *Ganoris melete*, Ménét., and *G. oleracea*, Harr., butterflies which are usually held to be respectively the Japanese and North American forms of *G. napi*.

Ganoris rapae, Linn. (England, 1899 (Dixey), 1903, and later). There is no manner of doubt that the males of this very familiar species also have a scent. But it is not as obvious as in *G. napi*; the scent is neither as strong nor as distinctive. Originally Dr. Dixey

compared it to that of Mignonette, but I think all are now agreed that Prof. Selwyn Image's comparison to sweet-briar is better, though even that is not exact.

Ganoris canidia, Sparrm. (India, China, 1903, 1904). The male has a scent like that of *G. rapae* (see especially pp. 98, 127, *supra*).

Ganoris brassicae, Linn. (England, 1903, 1904). It is more difficult to detect the scent in this than in either of our other common Whites, but neither Dr. Dixey nor myself have the slightest doubt of its existence. He compared the scent to that of Scarlet Geranium petals; I compared it to the flower of Rape. A lady visitor at Mortehoe suggested violet-powder—*i.e.* orris root—which is the best comparison. The scent appears to be confined to the male.

Mylothris agathina, Cram. (S. Africa, 1905). The males of this species have a strong, pleasant scent, exactly that of sweet-briar.

Mylothris rüppellii, Koch. (S. Africa, 1905). We could neither of us make any distinction between the scent of the males of this and the last species.

Mylothris trimenia, Butl. (S. Africa, 1905). The scent of the male is quite distinct from that of the two preceding species. It reminded Dr. Dixey of Sweet-pea; it reminded me of Clover.

Synchloë hellica, Linn. (S. Africa, 1905). Dr. Dixey compared the scent of the males to that of Gorse. I recorded a male as having a very slight, heavy, flowery odour. During a passing call at Cape Town, in 1909, I caught a solitary male with a sweet odour which seemed to me to have a resinous element.

PAPILIONINAE.

Ornithoptera darsius, Gray. (Ceylon, 1908). When at Kandy four years previously Mr. W. G. Freedley, junr., told me that the males of this species had a scent like Sassafras, but I had no opportunity then of confirming his statement. Every male that I examined during my more recent visit had a scent, some had a strong scent. At first I compared this to Cinnamon and to Canada-balsam; to Mrs. Longstaff it suggested Rosemary or "rose-scented hair-oil." Later by the kindness of the Apothecaries' Company of Colombo I received through the post a sample of the oil of Sassafras, so that I made a direct comparison, with the result that the odours of the oil and the butterfly appeared to be almost identical. The female had an odour like musty straw.

Papilio hector, Linn. (Ceylon, 1908). The male has a musty odour.

Papilio aristolochiae, Fabr. (Assam, 1881). Wood-Mason noted in the male a strong and slightly pungent odour resembling that of

(?) Bachelor's Buttons, or of the rose with a trace of acetic acid. (Ceylon, 1908). I found that both sexes have an odour like musty hay. To a male specimen there is a note: "decided disagreeable smell, (?) like new black net."

[*Papilio doubledayi*, Wallace. (Assam, 1881). Wood-Mason said that the male of this species had a musk-scented body.]

[*Papilio dasarada*, Moore. (Assam, 1881). Wood-Mason noted that the female had the strong scent of caged porcupines with a touch of musk.]

[*Papilio astorion*, Westw. (Assam, 1881). Wood-Mason noted in the female a strong and disgustingly rank musky odour.]

Papilio demodocus, Esp. (S. Africa, 1905). Both Dr. Dixey and I found an odour of fusty packing straw in both sexes of this species. I found it stronger in the female. Dr. Dixey sometimes found an element in the odour suggestive of cabbage-water, or a kitchen sink.

Papilio demoleus, Linn. (*erithonius*, Cram.). (Ceylon, 1908). A smell like fresh straw was detected in one specimen, a male; in another (a female) there was "a slight peculiar scent in the field: stronger in the house." At Mátherán (1908) a male had an odour like fresh straw.

Papilio dardanus, Brown. (S. Africa, 1905). The male has an odour of the musty straw type.

Papilio telephus, Feld. (Ceylon, 1908). A specimen had a slight sweet scent at home.

Papilio lyaeus, Doubl. (S. Africa, 1905). Some of the males examined had a scent which I described at the time as "sweet, luscious, flowery."

Papilio leonidas, Fabr. (S. Africa, 1905). Dr. Dixey thought the scent of the male to be like that of *D. chrysippus*, but I found in several males what I described as a "strong sweet, 'white-flower' scent, followed by something more spicy." The discrepancy must be admitted, but in all probability a greater supply of material would have cleared it up.

Papilio polydamas, Linn. [(Brazil, 1878). Fritz Müller found a very strong odour in the male sex. He goes on to say, "There appear to be two sets of males emitting equally strong, but quite different odours. This would be analogous to the case of the two sets of differently-coloured females in some species of this genus."]

(Jamaica, Trinidad, Venezuela, 1907). I detected an odour resembling that of musty hay, or straw, in two specimens of each sex. My wife compared the scent to Rue. My specimens were of the form *P. polycrates*, Hopff.

[*Papilio hyperion*, Hübn. (Brazil, 1878). Fritz Müller found that the males had a very strong odour.]

[*Papilio scamander* (? *grayi*) Boisd. (Brazil, 1878). Fritz Müller found a strong, most agreeable odour in the males.]

[*Papilio protesilaus*, Linn. (Brazil, 1878). Fritz Müller found "a very strong, or rather disagreeable, odour, in the male."]

[*Papilio nephalion*, Godart. (Brazil, 1878). Fritz Müller found a faint agreeable odour in the male.]

Papilio parinda, Moore. (Ceylon, 1908). A male was noted as having a scent like tea, but nothing of the kind was observed in any other specimens examined.

Papilio polymnestor, Cram. (Mátherán, India, 1908). A male had a somewhat musty odour.

Papilio eurimedes, Cram. (Venezuela, 1907). A male had a strong musty straw odour.

Papilio aeneides, Esp. (*gargarus*, Hübn.). (Trinidad, 1907). A living female had a smell of musty straw, which persisted after death.

[*Papilio alcinous*, Klug. (Japan, 1886). Of this species Pryer says: "The male emits a peculiarly sweet, musky odour when alive. The female also emits a faint odour, but to me this is as unpleasant as that of the male is pleasant."[1] I met with this insect near Nagasaki in 1904, but unfortunately did not examine it for scent.]

HESPERIDAE.

[*Plesioneura eligius*, Cram. (Brazil, 1878). Fritz Müller noticed in this species, as well as in a species of *Achlyodes*, that the pencil of long hairs on the hind tibiae of the males emitted a very faint odour.]

[*Gegenes occulta*, Trim. (S. Africa, 1905). Dr. Dixey found a very distinct chocolate scent in a male.]

As yet I have never been able to satisfy myself that any of the many Skippers examined are scented. It seems probable that some special manipulation may be requisite to elicit scents in this group.[2]

§ 2. THE COLOURED JUICE EXUDED BY CERTAIN LEPIDOPTERA.

It has long been known that some butterflies, notably *Danainae* and *Acraeinae*, yield a copious yellow or green juice on pinching, and this has been commonly associated with the known, or suspected, distastefulness of the insects themselves.[3] A devoted student of

[1] H. Pryer, "Rhopalocera Niphonica," 1886, p. 4; see also p. 155, *supra*.

[2] See Appendix, § VII.

[3] See Dixey, *Proc. Ent. Soc. Lond.*, 1906, pp. iii., iv., vi., vii.

entomology, the late Prof. Félix Plateau,[1] tried to get to the root of the matter by eating, or at any rate chewing, *Abraxas grossulariata* and its larva and pupa. Mr. Marshall has also tried many tasting experiments with South African butterflies.[2] The results were in both cases inconclusive. Prof. Poulton thinks that this is only what might have been expected, since we have no right to suppose that a given butterfly tastes the same to us as to an insectivorous bird. It might be added that the likes and dislikes of our domesticated mammals differ from our own. I must confess that no enthusiasm has so far availed to bring me to the point of chewing a butterfly. However, occasionally I have ventured to taste a minute drop of the yellow liquid, with somewhat unsatisfactory results.

Telchinia violae, Fabr. (India, 1904). "When injured a yellow juice exudes; a minute drop of this placed on the tongue tasted somewhat bitter and disagreeable, but the flavour was by no means strong."[3] (Ceylon, 1908). "The yellow juice slightly bitter."

Crastia asela, Moore. (Ceylon, 1908). In two males the juice was found to be tasteless: in another it had a slight, (?) bitter taste. In two females it was noted as "nearly tasteless," "tasteless, or nearly so."

Pademma sinhala, Moore. (Ceylon, 1908). The yellowish juice of a male is recorded as "(?) tasteless."

Trepsichrois midamus, Linn. (*superba*, Herbst). (Hong-Kong, 1904). "The yellow juice expressed by pinching has no marked taste."

Acraea natalica, Boisd. (S. Africa, 1905). The yellow juice slightly acrid.

A yellow juice, similar in appearance, has been noted in certain *Heterocera* believed to be distasteful. I give the instances which have attracted my attention.

Obeidia tigrata, Guen. (Hong-Kong, 1904). A conspicuous day-flying Geometer, allied to our Magpie-moth. Of this my note is: "Has a somewhat slow flight, and on the wing looks like a yellow butterfly; abundant and decidedly gregarious, many flying about one tree in the afternoon. When pinched it exudes a yellow juice having a bitter taste." I do not appear to have examined it for scent, but, whether or no it possesses an evil odour, it has other characteristics of a distasteful species.

Cartaletis libyssa, Hopff. (S. Africa, 1905). Dr. Dixey noted of

[1] *Mém. de la Soc. Zool. de France*, Tome vii., 1894, p. 375, § 7.
[2] *Trans. Ent. Soc. Lond.*, 1902, pp. 405–414
[3] See above, p. 88.

this remarkable Geometer, "which no doubt belongs to the synaposematic group headed by *D. chrysippus*, exuded when pinched a yellowish juice like that of an *Acraea*. The juice was scentless."[1]

Euschema transversa, Walk. (Ceylon, 1908). Of this handsome, very slow-flying, diurnal Geometer I recorded that it was extremely tenacious of life, but that its yellow juice was tasteless.

Chalcosia venosa, Walk. (Ceylon, 1908). This day-flying moth flutters much about trees (especially *Litsaea zealanica*, N. ab. E.), moving, however, faster from one tree to another, when its flight is somewhat "vapouring." It is tenacious of life, resisting alike pinching and chloroform. It has a peculiar, faint, disagreeable odour, and exudes a yellow juice, the flavour of which still invites investigation.

Deilemera (Nyctemera) annulata, Boisd. (New Zealand, 1910). This abundant moth is very tenacious of life; when pinched a yellow juice exudes which is tasteless, and if not also inodorous, very nearly so.

In contrast to these somewhat ambiguous results is the conspicuous S. African Acridian, *Phymateus leprosus*, Serv., which when touched emits copiously from the mouth a dark olive-green, very fetid fluid; accidentally tasted, this proved to be both bitter and unpleasant.[2]

§ 3. The Tenacity of Life of Protected Species.

That the *Danainae* and some other butterflies have unusually tough integuments which enable them to resist injuries such as would rapidly prove fatal to the butterfly of ordinary constitution has been long well known.[3] So far the undoubted fact rests to a great extent upon general statements, but it has occurred to the writer that it may be capable of approximate numerical expression.

With tropical collectors it is a familiar experience that at the close of the day, on opening the paper envelopes to examine their captures, many of the butterflies are found to be still living. It is an equally general experience that this is especially frequent with *Danainae*.

It has for some time past been my practice to enter in my notebook against the data referring to such long-lived individuals, "Ten. vit." (*tenax vitae*). During my visit to Ceylon in the early months

[1] *Proc. Ent. Soc. Lond.*, 1906, p. vi.

[2] See above, p. 204.

[3] See *e.g.* Poulton, "Essays on Evolution," 1908, pp. 279, 316. Cf. Bingham, "Fauna of British India: Butterflies," 1905, vol. i., p. 2. Also Marshall, *Trans. Ent. Soc. Lond.*, 1902, pp. 322, 323.

of 1908, I paid closer attention to the matter than previously, and feel confident that in the large majority of cases when a butterfly survived the first pinching the fact was duly recorded. The converse fact, that the insect was found dead in the envelope, was very rarely noted.

Somebody will doubtless lodge the plausible objection that many of the butterflies in the table are large insects: consequently that they should often survive a pinch, such as proved almost uniformly fatal to smaller species, is only what might have been expected. This objection is disposed of by the fact that such a large butterfly as *Cynthia asela*, Moore, was never (thirteen specimens) found alive in the paper at the end of the day; the same is true of *Cethosia nietneri*, Feld. (nine specimens), and of the robustly made and swift-flying *Hebomoia australis*, Butl. (thirteen specimens). Again, *Catopsilia pomona*, Fabr., is a fairly robust butterfly, yet out of forty-nine specimens three only, a ♂ and two ♀, were noted as tenacious of life.

From my note-books and previously published papers I find that this resistance to death has forced itself upon my attention in the following species:—

Trepsichrois midamus, Linn. (Hong-Kong, 1904).

Crastia amymone, Godart, f. *kinbergi*, Wallgr. (Macao, 1904).

Danaida chrysippus, Linn. (India, 1903, Sûdân, 1909). Noted as resistant to cyanide as well as to pinching.

Parnassius hardwickii, Gray. (Himálaya, 1903). Delicate looking though it be, it is strangely tenacious of life.[1]

Telchinia violae, Fabr. (India, 1904).

Chittira fumata, Butl. (Ceylon, 1904).

Acraea cabira, Hopff. (S. Africa, 1905). Noted as resistant to chloroform as well as to pinching.[2]

Danaida archippus, Fabr. (Jamaica, 1907).

Danaida eresimus, Cram. (Venezuela, 1907).

Danaida jamaicensis, Bates. (Jamaica, 1907).

Heliconius charithonius, Linn. (Jamaica, 1907). Mr. P. A. Buxton writes that he found this species and the preceding hard to kill.

Heliconius hydarus, Hew. (Venezuela, 1907).

Actinote antaeas, Dbl. & H. (Venezuela, 1907).

[1] In the discussion which followed the reading of the paper Dr. Chapman remarked that three or four pinches scarcely availed to kill the common Alpine *Parnassius apollo*, Linn.

[2] Mr. W. S. Loat, quoted by Dixey, *Trans. Ent. Soc. Lond.*, 1903, p. 149, says of *Acraea vinidia*, Hew., on the White Nile, "takes a long time to die when put in the killing-bottle."

Observations in Ceylon.

An examination of the following list of observations in Ceylon, January to March, 1908, shows, among other things, that whereas three-quarters of the specimens of *Papilio hector* taken, and three-fifths of those of *P. aristolochiae*, are recorded as tenacious of life, this is *not noted of any* of the nine specimens of *P. polytes*, five of *P. mooreanus*, four of *P. demoleus*, three of *P. teredon*, seven of *P. crino* and fourteen of *P. agamemnon*.

	Total specimens taken.	Tenacity of life noted in
DANAINAE.		
Parantica aglea, Cram.	31	17
Tirumala septentrionis, Butl.	18	9
Pademma sinhala, Moore	2	2
Narmada montana, Feld.	6	4
Crastia asela, Moore	51	33
„ *core*, Cram. (Mátherán)	6	4
Chittira fumata, Butl.	8	2
Danaida plexippus, Linn.	1	1
„ *chrysippus*, Linn.	4	0
PAPILIONINAE.		
Ornithoptera darsius, Gray	9	4
Papilio hector, Linn.	8	6
„ *aristolochiae*, Fabr.	15	9
„ *parinda*, Moore	13	4
„ *lankeswara*, Moore	3	1
„ *jason*, Esp.	3	1
„ *teredon*, Feld.	3	0
„ *crino*, Fabr.	7	0
„ *agamemnon*, Linn.	14	0
„ *polytes*, Linn.	9	0
„ *mooreanus*, Rothsch.	5	0
„ *demoleus*, Esp.	4	0
ACRAEINAE.		
Telchinia violae, Fabr.	10	3
NYMPHALINAE.		
Hypolimnas bolina, Linn.	9	2
PIERINAE.		
Delias eucharis, Drury	26	3
Catopsilia pomona, Fabr.	45	3
HETEROCERA.		
Chalcosia venosa, Walk.	12	4
Deilemera nigrovenosa, Moore	4	2
Euschema transversa, Walk.	2	1

To this list I may add *Deilemera annulata*, Boisd., an abundant New Zealand moth, of which I noted in 1910, "This conspicuous, slow-flying, abundant Hypsid moth is decidedly tenacious of life."[1]

The conspicuous Venezuelan Geometer *Josiomorpha cruciata*, Butl., comes into the same category.

So far as my observations go there is no difference in the powers of the two sexes of the butterflies here dealt with to resist injuries.

§ 4. Butterflies bearing Marks of the Attacks of Foes.

This very interesting bionomic point we owe almost entirely to Prof. E. B. Poulton, F.R.S., and Mr. G. A. K. Marshall.[2] The following lists of butterflies presumably injured by enemies, noted by me in the course of my travels, amply prove Prof. Poulton's statement that if only looked for many such specimens may easily be found. In nearly every case the injury is symmetrical, *i.e.* affecting the corresponding parts of both right and left wings, so that the probability of the injury being the result of accidental damage during flight by branches or thorns is very small.

It will be seen that it is nearly always the hind-wings that have borne the brunt of the attack.

Observations in India, 1903–4.

Precis lemonias, Linn. (*a*) Right hind-wing; ? lizard. (*b*) Anal angles of hind-wings, symmetrically.

Precis almana, Linn. Large pieces missing from both hind-wings, in part symmetrical.

Hypolimnas misippus, Linn. ♂. Both hind-wings, injury in part symmetrical.

Pyrameis cardui, Linn. Apex of both fore-wings, and anal angle of left hind-wing.

Vanessa kashmirensis, Koll. A large piece of hind margin of hind-wings bitten out square, sparing the anal angles; ? lizard.

Orsotriaena meda, Fabr. A well-marked bite on hind margins of hind-wings above anal angle; closely corresponding.

Ypthima hübneri, Kirby. The whole of the hind margin of both hind-wings bitten off nearly symmetrically.

[1] See above, p. 443.

[2] Poulton, "Essays on Evolution," 1908, pp. 270, 281–283, 325, as well as the references there given. Even Prof. Punnett admits the cogency of this line of argument, but considers that the injuries are mainly due to Lizards. *Spolia Zeylanica*, vol. vii., Part xxv., p. 12 (1910).

Curetis thetis, Drury. (No details recorded.)

Ilerda epicles, Godart. ♀. All the hinder part of hind-wings.

Pratapa deva, Moore. Anal angles, tails and large part of hind-wings bitten off absolutely symmetrically.

Polyommatus baeticus, Linn. Two-thirds of hind-wings gone.

Colias fieldii, Ménét. ♀. Hind-wings possibly bitten by a bird—somewhat symmetrically.

Catopsilia pyranthe, Linn. A symmetrical bite out of both hind-wings.

Ixias pyrene, Linn. ♂. Fore-wings almost symmetrically bitten near the tip of the costa.

Terias hecabe, Linn. ♀. "Bird-pecked."

Terias laeta, Boisd. Dr. Dixey wrote: "Is prettily mutilated by a bird."

Ganoris canidia, Sparrm. ♀. All the hind margin of the hind-wing (? wings) gone.

Belenois mesentina, Cram. ♀. Hind margins of hind-wings symmetrically bitten: ? by lizard.

Teracolus etrida, Boisd. ♂. Apex of left fore-wing, all its hind margin, and apex of left hind-wing gone: ? a case of successful "direction."

Papilio hector, Linn. A remarkably symmetrical bite of the tip and half hind margin of both hind-wings. The very "warning marks" snapped at.

Papilio pammon, Linn. ♀. Bitten by bird.

Observations in Ceylon, 1904.

Tirumala septentrionis, Butl. A ♀ with hind-wings much broken, but only in part symmetrically; a ♂ with a double bite near the anal angles of the hind-wings.

Cirrhochroa cognata, Moore. The hind-wings very symmetrically chipped near the anal angles: ? by bird.

Hypolimnas bolina, Linn. ♂. Anal angles of the hind-wings injured, in part symmetrically.

Argynnis hyperbius, Johanss. (*niphe*, Linn.), ♀. Apex of both hind-wings and anal angles of both fore-wings symmetrically bitten.

Lethe drypetes, Hew. (*a*) Hind margin of hind-wings bitten off in fair agreement. (*b*) Both hind-wings bitten at anal angle.

Terias hecabe, Linn. ♀. Hind-wings bitten more or less symmetrically.

Catophaga paulina, Cram. ♂. A symmetrical injury to the tips of the hind-wings.

Papilio aristolochiae, Fabr. The tips of the hind-wings bitten off in striking symmetry.

Papilio dissimilis, Linn. Anal angles of hind-wings and more bitten off fairly symmetrically.

Observations in China, 1904.

Papilio paris, Linn. Large pieces bitten out of fore and hind-wings almost symmetrically.

Observations in Japan, 1904.

Blanaida goschkevitschii, Ménét. The anal angles of both hind-wings symmetrically bitten off, otherwise in fine condition.

Gonepteryx rhamni, Linn. ♂. Symmetrically pecked by a bird, all four wings implicated.

It will be noted that this list includes no *Danaida* nor *Euploea*, but does include two *Tirumala septentrionis*, and two Papilios with conspicuous red " warning marks."

In Ceylon a bird was seen to make a swoop at a male *Catophaga paulina*, but missed it. I may here add that at Yokohama, May 19th, 1904, I saw a dragon-fly of moderate size, *Orthetrum japonicum*, Uhler, carry off a *Blanaida goschkevitschii*, a butterfly resembling a very large *Pararge megaera*, which did not appear to struggle at all.

Observations in Algeria, 1905.

Euchloë belia, Linn. ♀. Very sharply-cut snip out of each hind-wing, larger on left: ? by bird.

Ganoris brassicae, Linn. Caught fluttering about flower-bed close to the ground, had been nearly done to death by a (?) bird; nearly the whole of both hind-wings and three-fourths of the fore-wings gone.

Observations in South Africa, 1905.

Precis sesamus, Trim. A piece out of one hind-wing.

Tarucus telicanus, Lang. ♀. Fore-wings injured: ? by bird.

Pinacopteryx charina, Boisd. ♂. (*a*) Anal angles of hind-wings bitten: ? by lizard. (*b*) Both anal angles of hind-wings bitten off: ? by lizard.

Neotropical Butterflies (West Indies, Venezuela, etc.), 1907.

Euptychia pharella, Butl. A small symmetrical injury to tips of fore-wings: ? by bird.

Euptychia hesione, Sulz. Symmetrical injury to middle of hind-wings: ? by bird.

Anartia jatrophae, Linn. A big unilateral injury involving both right wings, noted before capture.

Cystineura dorcas, Fabr. Symmetrical injury to tips of hind-wings.

Didonis biblis, Fabr. ♀. Injury to anal angles of both hind-wings.

Myscelia cyaniris, Hew. Symmetrical injury to hind-wings: ? by bird.

Aganisthos orion, Fabr. Symmetrical injury to hind-wings: ? by lizard.

Colaenis cillene, Cram. ♂. (*a*) Nearly symmetrical injury to anal angles of fore-wings. (*b*) Symmetrical injury to hind-wings: ? by lizard.

Heliconius charithonius, Linn. ♂. Symmetrical injury to hind-wings.

Thecla togarna, Hew. ♀. Symmetrical injury to hind-wings, involving lobes and tails.

Glutophrissa drusilla, Cram. ♂. Symmetrical injury to both hind-wings: ? by lizard.

Terias delia, Cram. ♀. Symmetrical injury to hind-wings.

Terias messalina, Fabr. ♀. Symmetrical injury to hind-wings.

Observations in Ceylon, 1908.

Crastia asela, Moore, ♀. Nearly all hind-margin of right fore-wing and apex of right hind-wing gone.

Crastia core, Cram. (Mátherán, India). Symmetrical injury to hind-wings.

Narmada montana, Feld. ♂. Symmetrical injury to fore-wings.

Yphthima ceylonica, Hew. Small symmetrical injury to fore-wings: ? by bird.

Melanitis leda, Linn. Symmetrical injury to anal angles of fore-wings: ? by bird.

Neptis varmona, Moore. Symmetrical injury to fore-wings: ? by lizard.

Cethosia nietneri, Feld. ♀. (*a*) Symmetrical injury to middle of hind-wings. (*b*) Symmetrical injury to tips of fore-wings.

Cynthia asela, Moore. (*a*) ♀. Large symmetrical injury to hind-wings: ? by lizard. (*b*) ♂. Symmetrical injury to hind-wings; ? by bird.

Cirrhochroa cognata, Moore, ♀. Symmetrical injury to hind-wings.

Hypolimnas bolina, Linn. (*a*) ♀. Symmetrical injury to fore-wings: ? by bird. (*b*) ♂. Symmetrical injury to tips of fore-wings.

Pyrameis cardui, Linn. ♂. Symmetrical injury to hind-wings: ? by lizard.

Lampides celeno, Cram. ♂. Symmetrical injury involving whole hind-margin of hind-wings and an angular piece of fore-wings: ? by lizard.

Delias eucharis, Drury, ♂. Symmetrical injury to hind-wings.

Catopsilia pomona, Fabr. (*a*) ♂. Two symmetrical (?) bites involving both hind-wings. (*b*) ♀. Symmetrical injury to hind-wings: ? by bird. (*c*) ♂. All four wings symmetrically injured by one small bite: ? by bird.

Ornithoptera darsius, Gray, ♀. Long narrow symmetrical injury to hind-wings: ? by bird.

Papilio agamemnon, Linn. Symmetrical injury to hind-wings: ? by lizard.

Observations in India (Mâtherân), 1908.

Crastia core, Cram. A male with a symmetrical injury involving both hind-wings.

Zezius (Thecla) chrysomallus, Hübn. A male had been bitten.

Observations in the Sûdân, 1909.

Colias hyale, auct., f. *marnoana*, Rogenh. (*a*) Symmetrical injury affecting fore and hind-wings. (*b*) Injury involving all four wings.

Belenois mesentina, Cram. ♂. A large piece out of all four wings.

Teracolus halimede, Klug. A large piece out of one hind-wing.

§ 5. Experimental Evidence as to the Palatability of Butterflies.

The following experiments, conducted at the suggestion of Prof. Poulton, are a small contribution to the mass of facts accumulated by Mr. G. A. K. Marshall and Mr. Frank Finn.[1]

[1] Marshall, *Trans. Ent. Soc. Lond.*, 1902, pp. 297–397; Finn, *Journ. Asiat. Soc. Bengal*, lxiv. Pt. ii. 1895, p. 344; lxv. Pt. ii. 1896, pp. 42; lxvi. Pt. ii. 1897, pp. 528, 613, 667, 668; quoted by Poulton, "Essays on Evolution," 1908, pp. 269, 317. See also Marshall, *Trans. Ent. Soc. Lond.*, 1908, pp. 137–142.

At our hotel at Kandy were two Mainas (*Gracula*), talking birds of the Starling family (*Sturnidae*). These birds, which were very tame, were confined in two fairly roomy cages three or four yards apart. I will call the birds A and B.

None of the butterflies offered to the birds was stiff; all had been killed earlier in the same day.

January 19, 1908. Bird A was given 5 dead butterflies in the following order:—*Atella phalantha*, *Polyommatus baeticus*, *Loxura arcuata*, *Neptis varmona*, *Telchinia violae*. The bird gave the *Loxura* a few pecks and then let it alone. The tough integument of the *Telchinia* seemed to give the Maina much trouble, but it showed no evidence of disgust. The other three butterflies were taken greedily, the bird, like Oliver Twist, obviously asking for more. It shook the butterflies as a dog shakes a rat.

January 21, 1908. Bird A appeared to be very anxious to be fed. I gave it a dead *Catopsilia pomona*, ♀, which was pecked to pieces: next a dead *Parantica aglea*, it ate its abdomen: then a dead *Papilio aristolochiae*, after giving this several pecks it was left and not touched again. I then gave it two *Crastia asela*, both alive; the fact of life seemed to interest the bird and it tried each of the specimens twice, but then appeared to be disgusted and refused even to look at any of the following, of which dead individuals were put into its cage: *Papilio agamemnon*, *Jamides bochus*, a small Lycaenid (probably either a *Catochrysops* or a *Nacaduba*), *Loxura arcuata* and *Neptis varmona*.

Same day. Gave bird B a dead *Atella phalantha*, which it ate; after this a living *Crastia asela*, it pecked this several times but did not eat it.

January 23, 1908. Bird A was busy preening its feathers and appeared to have just been fed; I could not attract its attention. While thus engaged bird B sought to attract *my* attention, so I gave it in succession dead specimens of:—*Ergolis* sp., *Telchinia violae*, *Delias eucharis* and *Papilio aristolochiae*. It gave the two first a few pecks; the *Delias* it pecked once or twice, but it gave the *Papilio* a single peck only. Perhaps it was not hungry.

I then put the last two butterflies into the cage of bird A. It pecked the *Delias* several times, but the *Papilio* only once or twice. After this it declined even to look at the *Papilio* any more, but came to the front of its cage uttering again and again sounds ridiculously like "No good! No good!"

February 2, 1908. Gave Maina A a dead *Nissanga patnia* which it appeared to eat.

February 4, 1908. The Mainas had evidently been fed; there was food in their cages, which bird A had upset.

Gave A an *Ergolis* sp., which it ate.

Gave B a *Nissanga patnia*; it ate it.

Offered a living *Hypolimnas bolina*, ♂, first to one bird, then to the other; each pecked its wing, but no more.

Bird *A* would not look at *Cirrhochroa cognata*.

I came to the conclusion that the birds were not hungry, and therefore the observations of little value.

February 7, 1908. Offered to two young chickens first a *Papilio aristolochiae* and then a *P. polytes*, ♂. One of them looked at the first-named and then walked away; neither looked at the *polytes*.

The same two butterflies were then offered to Maina A, which pecked at both several times, then wiped its beak and left them.

This day's experiments were considered unsatisfactory at the time; it was nearly 6.0 p.m., and perhaps the birds were sleepy.

February 14, 1908. Gave bird *A* a *Lampides* sp.; it ate it and looked about for more.

February 15, 1908. Gave bird *A* two *Yphthima ceylonica* and one *Lampides* sp.; it ate them all three. A *Neptis varmona* was then offered to the same bird, which gave it but one peck. The *Neptis* was then offered to bird B, which also gave it one peck.

February 16, 1908. Gave to bird A three butterflies, *Lampides* sp., another Lycaenid (species not noted), and a *Nissanga patnia*: it ate them all up completely. Another specimen of the *Nissanga* was swallowed at the second attempt. An *Ergolis* sp. was also eaten and swallowed. I then offered the same bird a *Papilio aristolochiae*, this after a peck or two was left. The same specimen was then offered to bird B, which would not touch it. It was then handed back to bird A, which gave it another peck and again left it.

So far as these experiments teach anything, it would appear that these Mainas would eat with relish *Nissanga patnia*, *Yphthima ceylonica*, *Atella phalantha*, *Ergolis* sp., and *Lampides* sp.

On the other hand, *Papilio aristolochiae* and *Crastia asela* were distinctly distasteful.

The evidence as to the other species experimented with fails to convince me one way or the other.

During the summers of 1909 and 1910 Mr. R. I. Pocock, F.R.S., conducted an important series of experiments in the gardens of the Zoological Society of London. Butterflies of many species, a few Moths, Lepidopterous larvae; conspicuous Beetles, such as *Carabus*, *Timarcha*, *Rhagonycha*, and *Coccinella*; Bees and Dipterous flies that appear to mimic them, as well as several creatures belonging to other groups, were offered to various Mammals and Reptiles, as well as quite a large number of Birds.

Mr. Pocock, after explaining the difficulties attending his experiments, says: "Two facts struck me very forcibly. . . . The first was the exceeding keenness of the birds for the insects brought to them. . . . The living prey was evidently a great treat to them; and over and over again I was impressed with the persistence shown by birds in persevering with insects that were obviously not to their liking, returning to the morsels repeatedly as if food of such a nature was too good to be wasted . . . it is quite clear that the plain record of an insect being eaten is no proof of its palatability. Better evidence . . . is supplied by the behaviour of the bird towards it. . . . The second fact . . . the insectivorous birds in our aviaries seemed to know at once what the butterflies were; they were on the alert the moment one was liberated and pursued it with determination and precision, following its every turn and twist, and either catching it upon the wing or pouncing upon it after settling. . . . Again, unless the species of butterflies used for the experiments are, or were in the past, habitually preyed upon by birds, whence comes the extraordinary skill the liberated specimens . . . displayed in dodging the swoop of the birds in mid-air? . . . With regard to the experiments on mimicry, especially those made with *Volucella bombylans* and *Bombus hortorum*, it appears to me that they satisfy all that the theory, as propounded by Bates, demands. . . . They show that several species of birds, after learning by experimental tasting that *Bombus hortorum* is unpalatable, refused to touch *Volucella bombylans*."[1]

The paper deserves careful perusal, and the writer is proud to have been able to supply some of the material for the experiments.

[1] "On the Palatability of Some British Insects, etc.," R. I. Pocock, F.R.S., etc. With notes by Prof. E. B. Poulton, F.R.S. *Proc. Zool. Soc. Lond.*, 1911, pp. 809–868.

§ 6. Mimics in the Field deceiving Man.

It may not be without interest to record a number of cases in which a collector with defective eyesight has actually been deceived (at any rate momentarily) by Mimics in the field.

Benares, November 30, 1903. When I first captured *Hypolimnas misippus*, ♀, I believed it to be a variety of *Danaida chrysippus*, and I think it probable that other specimens were passed over, as males were very common.

Anántapúr, February, 1904. This note was made: "Several times saw the ♂ *H. misippus* reconnoitring *D. chrysippus* as if in doubt as to its identity."

Malakand, October 29, 1903. *Argynnis hyperbius*, ♀, flying about flowers was noticed to resemble *Danaida plexippus*, which was in abundance at the same flowers, though in this case there was no actual deception.

Konúr, Nilgiris, February, 1904. On one occasion I watched for some time a female of *Argynnis hyperbius*, under the impression that it was *Danaida chrysippus*. The resemblance on the wing is greater than might be supposed.

Horton Plains, Ceylon, March 23, 1904. The female *Argynnis hyperbius* on the wing looked very like *Danaida chrysippus*.

Hatton, Ceylon, March, 1908. The following extracts from my note-book point to the striking difference in the general look of the two sexes of *A. hyperbius* when on the wing:—

"a female, captured as *Danaida chrysippus*."

"a male, looked like a Fritillary."

I would urge strongly that the resemblance of model to mimic may be much closer in the field than in the cabinet. To some extent the converse is probably true.

Báliganj, Calcutta, December 5, 1903. "The female *Elymnias undularis*, Drury, is a very fair mimic of *Danaida plexippus*, but its flight is weaker."

Kandy, February 9, 1908. A tattered ♀ of *Elymnias fraterna*, Butl., was taken for a tattered *Danaida chrysippus*.

Haragáma, Ceylon, February 13, 1908. A female *Nepheronia ceylonica*, Feld., on a *Lantana* flower, was taken for *Parantica aglea*.

Durban, S. Africa, August, 1905. *Acraea encedon*, Linn., a somewhat feeble insect with slow flight, was, in spite of its small size, twice momentarily believed to be *D. chrysippus*, which was seen in the same spots on the same days. On the other hand,

a small female *D. chrysippus* was actually mistaken for *A. encedon*.

Durban, August, 1905. "Of *Belenois thysa*, Hopff., we took two males; when on the wing they were very like the males of *Mylothris agathina*, Cram., in flight and general aspect. Indeed as seen in the net the *Belenois* so closely mimics the *Mylothris* that one of us, though specially on the look-out, was completely deceived, and this even when the two insects were taken the same morning" (see above, pp. 193, 194).

Durban, August, 1905. ". . . the curious Geometer *Cartaletis libyssa*, Hopff., of which several were seen, but only one taken. It flies rather high, with feeble fluttering action, and when on the wing somewhat recalls *Danaida chrysippus*." I do not think that in this instance I was actually deceived.

Kandy, March, 1904. Of the tail-less *Papilio lankeswara*, Moore, f. *dissimilis*, Linn. (the pale form), I took three, but probably saw more since it so very closely mimics *Tirumala limniace*, or a large *Parantica aglea*, as easily to pass for one of those insects; it is indeed most easily distinguished from them by its habit of fluttering while feeding upon a flower.

Near Peradeniya, Ceylon, January 29, 1908. I was with that experienced and keen-eyed entomologist, Mr. E. E. Green, when after several attempts he netted a *P. lankeswara*, f. *dissmilis*, under the impression that he was catching *Tirumala septentrionis*, Butl. (see above, p. 364).

Kandy, March 2, 1908. I myself took a female *P. dissimilis* which I imagined to be *Tirumala septentrionis* as it flew past.

Haragáma, Ceylon, February 18, 1908. Took a female *P. lankeswara*, f. *clytia*, Linn. (the dark form), believing it to be *Crastia asela*, Moore. This dimorphic mimicry is very remarkable.

Mortehoe, Devon, July, 1902. The first *Aegeria crabroniformis*, Lewin, that I ever saw alive was at rest on the trunk of a black Poplar. Under the idea that it was a hornet I knocked it down and put my foot on it before discovering my mistake. The thought passed through my mind: "Well, I have been here all these years and never saw a Hornet in the district before."[1]

Kandy, February 21, 1908. A specimen of the Clearwing, *Melittia chalciformis*, Fabr., seen hovering over a flower was first thought to be a *Bombylius*, then a Skipper. It distinctly hummed in the net. This instance is quoted to show that the moth, though not suggesting a protected insect, certainly deceived the observer.

[1] Longstaff, *Entom. Month. Mag.*, 2nd Ser., vol. xv., 1908, p. 196.

Simon's Town, S. Africa, October 3, 1905. I had much difficulty in distinguishing during life some flies—? *Ploas* sp., and *Prorachthes* sp.—from certain small black, white-ringed Bees, *Halictus albofasciatus*, Smith, ♂, which buried themselves in the flowers of a large *Mesembryanthemum*; in the cabinet the insects look distinct enough, but during life the resemblance, especially in their movements and habits, was quite remarkable (see p. 250, *supra*).

Mátherán, W. Ghats, 1908. At the end of March, in a time of extreme drought, insects of various orders were, naturally enough, attracted to such pools as were left about the nearly exhausted springs. Among the visitors were many long-waisted Wasps of which I secured a fair number, belonging, as I supposed on a cursory glance, to several species. When Mr. A. H. Hamm had set these for me at Oxford, he remarked, "I see that you have taken a lot of *Conops* along with the wasps that they mimic." Critical examination revealed:—HYMENOPTERA: *Eumenes flavopicta*, Blanch., three; *E. edwardsii*, Sauss., one; *Icaria ferruginea*, Fabr., four; *Polistes marginalis*, Fabr., var. *stigma*, Fabr., one. DIPTERA: *Ceria, sp. nov.* (near *trinotata*, de Meijere), three; *Ceria eumenoides*, Saunders, seven. How close was the mimicry of Fly to Wasp may be judged from the figures on Plate IV. The mimicry of *Icaria* by *C. eumenoides* had been noticed by Col. C. G. Nurse in 1899, also at Mátherán.[1]

Mortehoe, Devon, August, 1908. Two specimens of the common British fly, *Conops flavipes*, Linn., suggested to me when alive a *Trochilium* (Clear-wing Moth) rather than a Wasp. But the next one that I came across was netted on the wing as a small wasp. Subsequently other specimens were seen running about on leaves (especially of *Hydrangea*), and the close resemblance of their moments to those of a Vespid were noticed on at least two occasions. The abdomen was frequently raised and depressed, and there was a general fidgetiness of manner that was highly suggestive of a wasp, but, unlike a wasp, the antennae remained rigidly porrected, so as to be strangely conspicuous.

Mortehoe, Devon, 1906, and subsequently. The Syrphid fly, *Chilosia illustrata*, Harr., which is to be seen commonly enough on Ragwort flowers and various Umbellifers, is a fairly close mimic of *Bombus sylvarum*, Linn., and the more local *Podalirius furcatus*, Panz. They may often be seen side by side on the same flower-head, and it requires a little care to distinguish them,

[1] See above, p. 392.

though I cannot remember having made any mistakes of diagnosis myself. The mimicry is sufficiently close to have deceived for the moment such an experienced hymenopterist as Dr. H. Swale.

Mortehoe, Devon, 1909. Of the Syrphid fly, *Volucella bombylans*, Linn., both forms occur, *plumata* and *bombylans*; they are close mimics of *Bombus terrestris* and *Bombus lapidarius* respectively, and I have actually taken the latter form of the fly for the Bumble-bee.

Mortehoe, Devon, 1909. The Syrphid fly, *Arctophila mussitans*, Fabr., is so extraordinarily like the tawny Bumble-bee, *Bombus agrorum*, on the wing that I have several times been thoroughly deceived. I have taken the two insects together, on the same day, on the same patch of *Centaurea nigra*; the Bumble-bee very common, the fly comparatively scarce—all the classical conditions of Batesian mimicry.

New South Wales, 1910. I do not think that I have ever been so completely taken in as at Como, near Sydney, on the 2nd of April. On the flower of a shrubby Acacia, well within reach and clear sight, was, as I thought, a fine wasp. It was easily netted, but not so easily bottled. I pursued it up and down the net with cyanide-bottle, taking great care not to be stung. Once corked up I thought no more about it, until on turning out the bottle after the day's work I found a black and orange Longicorn beetle! The female of *Esthesis variegatus*, Fabr., has extremely short elytra, and as the beetle sat on the flower its wings were extended on either side, as one often sees in Fossors (see Plate VI., Figs. 8, 9). I did not observe any wasp very like it (but see above, p. 485).

Mortehoe, 1907, and subsequently. My garden is unusually rich in Diptera mimics, though the number of individuals is mostly small. This is true of the enormous black Tachinid fly *Echinomyia grossa*, Linn., which in appearance, voice and manner is a good mimic of *Bombus hortorum*, var. *harrisellus*. As neither is common, I have not seen them together, though I have taken them within a few yards of one another. That they can be distinguished on the wing is doubtless true, but I venture to think that it is also possible to confound them.

Of course we can form but a very imperfect idea of the sense impressions of the lower animals. We know by their actions that hawks see their prey from a considerable distance. The phenomena

of mimicry compel the inference that insectivorous birds, and possibly lizards, appreciate comparatively minute differences of shape and colour, yet it is quite conceivable that they cannot distinguish these at a greater distance than a myopic man. We know even less about the sense impressions of insects, in spite of the patient observations of Forel and Lubbock, and the brilliant experiment of Exner. The whole subject is discussed in detail by Dr. Auguste Forel, who seems to have established the fact that insects have a very keen perception of movement—possibly far more acute than their sense of form and colour.[1] It has often occurred to me when collecting butterflies that it is just possible that they can smell a collector as far as they can see him.

Some opponents of mimicry seem to think that they have proved their case when they declare that model and mimic *can* be distinguished, or when they cite cases of birds attacking distasteful species.

Since the last paragraph was written powerful attacks upon the whole theory of mimicry have appeared. Those of Col. N. Manders deserve special attention on account of the wide experience of their author. His chief point is that he denies that birds exercise discrimination in their attacks on butterflies.[2] I agree with Professor R. C. Punnett,[3] that the first steps towards mimicry present great difficulties, but I fail to see that Mendelism has any light to throw on the subject. It is remarkable that Professor Punnett, whose power of diagnosing insects on the wing appears to be exceptional, should nevertheless have been deceived by the resemblance to Butterflies of a Dragon-fly (*Rhyothemis variegata*, Johanns.), and a Homopterous Bug (*Hansenia glauca*, Kirby). As regards the latter, which I saw two or three times at Kandy, I have a note: "very blue on the wing, but flight much slower than a Lycaenid." Again, is Professor Punnett justified in his assumption that a bird reasons about the flight of a butterfly in the way that a scientifically trained naturalist does? Such severe criticisms as these two authors have published cannot but increase our knowledge of a difficult subject, but the *coup de grâce* has not yet been delivered.

Once more it must be repeated that no supporters of the theory claim that the disguise is never seen through, nor do they claim that distasteful species are never eaten. In the severe struggle for

[1] Forel, "The Senses of Insects." Translated by Macleod Yearsley, 1908, *passim*.

[2] Manders, *Trans. Ent. Soc. Lond.*, 1911, pp. 417–425; also, *Proc. Zool. Soc. Lond.*, 1911, pp. 696–749.

[3] Punnett, *Spolia Zeylanica*, vol. vii., part xxv., 1910, pp. 1–24.

existence, if the mimetic guise often, or even occasionally, leads to the escape of the protected species, it must be a great advantage to it. The same argument applies to distasteful qualities.

The question to be decided is not, "Is the disguise *always* successful in deceiving *all* enemies?" but rather "Does it *ever* deceive *any* enemies?"

§ 7. Notes on the Flight of Sundry Butterflies.

Too many systematic works deal with insects as mere cabinet specimens, though there are notable exceptions. Not the least valuable part of the late Mr. C. G. Barrett's great work on the "Lepidoptera of the British Islands" is his vivid description of their habits and flight. Again in Moore's "Lepidoptera of Ceylon" the short notes on the mode of flight of many species supplied by Capt. H. Wade-Dalton, Mr. F. M. Mackwood and more frequently Capt. F. S. Hutchison are of great interest. The value of the notes in the last-named work is not diminished by the fact that the observers are not always agreed. The habits of the sexes are usually different; the time of day, not to speak of the weather, greatly affects their flight; probably the time that may have elapsed since emergence from the pupa is another important factor. From these facts it follows that hasty generalizations based on even the most accurately recorded observations may be misleading if the qualifying circumstances be left out of account.

The first fact that I would emphasize is the rapid flight of the Whites and Yellows.[1] That Pierines may be seen fluttering about flowers is true enough, *e.g. Colias edusa* is not always difficult to catch. Nevertheless the Pierine has a knack of flying straight ahead in a business-like manner, as if bound to reach some distant place at a definite time, in a way that the Satyrine rarely, if ever, adopts. Again, though the Nymphaline may go off at a great pace for a short distance, it usually soon returns to its beat. Among many swiftly flying Pierines that I have come across, are:—the allied genera *Catopsilia*,[2] *Callidryas*[3] and *Gonepteryx*; *Catophaga paulina*; the Neotropical *Glutophrissa drusilla*, and more especially *Pieris phileta*;[4] the powerful Oriental *Hebomoia*;[5] again *Ixias pyrene*

[1] See above, pp. 44, 58, 98.

[2] See above, p. 58.

[3] See above, pp, 286, 331.

[4] See above, p. 287.

[5] See above, pp. 102, 114, and subsequent experience in Ceylon.

though not equal to the last-named, is a swift flyer, as are also many of the *Teracoli*, notably the South African *T. eris*.[1]

Commander J. J. Walker, R.N., writing of *Euchloë belemia*, Esp., at Gibraltar, Tangier, etc., said: "It has a very strong, swift, and erratic flight, and is by no means easy to catch."[2] Even the little *Terias*, which seems to go slowly, will be found to move so fast that a large proportion get away, though in this instance the mode of escape is commonly to dart downwards so that the net passes over the butterfly, and to the annoyance of the collector it rises again from the ground. There seems to me to be practically no doubt that the swift flight of the Whites and Yellows is due to their exceptional conspicuousness as compared with other butterflies. That they are exceptionally conspicuous is obvious enough.

Yet not all Pierines are rapid flyers; there are marked and significant exceptions. Thus, many years ago, Dr. A. R. Wallace,[3] writing of the Oriental genus *Thyca* (*Delias*), said: "They have a very slow and weak mode of flight." Again, at East London, Dr. Dixey called my attention to the "slow, fearless, fluttering flight" of *Mylothris agathina*, Cram. Both *Delias* and *Mylothris* furnish well-known models, closely mimicked by other Pierines. Dr. Dixey noted that the flight of the mimic *Belenois thysa*, Hopff., closely resembled that of its model *Mylothris agathina*, but Mr. E. E. Green tells me that *Prioneris sita*, Feld., a very close mimic of *Delias eucharis*, Cram., is a swift flyer.

On March 30th, 1910, at Como, 12 miles S.S.W. of Sydney, New South Wales, I saw a number of males of *Delias nigrina*, Fabr., flying about the tops of Gum-trees (*Eucalyptus* sp.) that were in flower. They kept for the most part 30 or 40 feet from the ground, rarely coming down within reach. The upper side of the male is white with an apical black mark, the lower side mostly black. The effect of this strangely contrasted colouring was curious. The black and white surfaces showed alternately as it flew slowly about the flowers, and at first I took the butterfly for something much larger than it really was—to me it seemed a huge *Papilio*—I have seldom been so deceived in the size of an insect. The movement of the wings gave the butterflies a distinctly blue look, as might have been expected from the partial mingling of black and white.

Probably belonging to a different category are two smaller Pierines

[1] See above, p. 222.

[2] *Entom. Month. Mag.*, vol. xxiv., p. 181 (1886–1887); also *Trans. Ent. Soc. Lond.*, 1890, p. 369.

[3] *Trans. Ent. Soc. Lond.*, Ser. 3, vol. iv., 1865–8, p. 309.

of dissimilar structure, but similar appearance, the Palaearctic *Leucophasia sinapis*, Linn., and the Oriental *Nychitona xiphia*, Fabr.,[1] which are among the very feeblest fliers of my acquaintance.

The slow gliding, floating (Hutchison), or skimming flight of certain Nymphalines, such as *Neptis, Rahinda, Ergolis,* and *Eurytela,* is well known to tropical collectors; what its significance may be I know not. My experiments indicate that *Ergolis* is palatable.[2]

It has not been my good fortune to capture that fine butterfly *Parthenos cyaneus,* Moore, but at Kandy I watched its tantalizing movements for some time as it flew to and fro far above my longest net-stick. Messrs. de Nicéville and Manders say of this species, "not rare, but is difficult to catch. It has a remarkably distinctive mode of flight, which makes it recognizable at once on the wing."[3] As those naturalists made no attempt to describe its peculiarity I will endeavour to do so:—The wings appear to be seldom raised much above the horizontal, but at comparatively long intervals they are strongly depressed with a jerk, the fly then gliding along for two or three yards. In marked contrast to this is the flight of *Papilio parinda,* Moore, attended with obvious flapping in which the wings are much raised but never appreciably depressed below the horizontal. I am glad to be able to add that Mr. E. E. Green agrees with the general accuracy of this description.

The slow heavy flight of the Danaines is of course familiar; I might specially mention *Crastia asela,* Moore; *Narmada montana,* Feld.; *Chittira fumata,* Butl.; and *Parantica aglea,* Cram. I am, however, not aware that the peculiar dancing movement—up and down—of the two last-named has been placed on record: yet it was often so marked as to enable me to diagnose the insects at a considerable distance. At Kandy late in the afternoon, when other butterflies were getting scarce, *P. aglea* might often be seen slowly dancing about in all directions.

At the Falls of the Zambesi I noted *Papilio leonidas,* Fabr., as flying slowly "with the manner of a Danaid"; this made me suspect it to be a mimic, as I afterwards found to be the case.[4] Mr. Marshall, who is quite familiar with the insect, whereas I have seen but very few specimens, speaks of *P. leonidas* as having a strong and rapid flight, and always going straight ahead.[5] I think there must have

[1] See above, p. 61. Also Ceylon, 1908.
[2] *Supra,* pp. 526, 527.
[3] *Journ. Asiatic Soc. of Bengal,* vol. lxviii., 1899, p. 188.
[4] See above, p. 229.
[5] *Trans. Ent. Soc. Lond.,* 1902, p. 507.

been some special circumstance that caused my specimens to behave in an unusual manner. Certainly its alleged model, *Tirumala petiverana*, did not put in an appearance.

The flight of *Cethosia nietneri*, Feld., another Ceylon butterfly, is I think about the slowest and weakest that I have observed, and this alike whether it be high up or near the ground. The S. African Nymphaline, *Salamis anacardii*, Linn., is another remarkably slow flyer.[1]

As a general rule tropical butterflies seem harder to catch than British. Certainly this is not entirely to be explained by the heat, nor even by swiftness of flight. The slow-flying *Mycalesis* seldom moves far, and is for that very reason hard to catch as it seldom gets quite clear of the herbage amongst which it is found. Again, *Elymnias* often refuses to move more than two or three yards when disturbed, yet is hard to catch because it will not get clear of the bushes, in the middle of which it loves to flutter. A very different butterfly, the exquisite blue *Nepheronia ceylanica*, Feld., a quick flyer, often takes refuge in bushes when pursued; *Teracolus puellaris*, Butl., has a similar habit. *Belenois mesentina*, Cram., and the two common Indian species of *Ixias* seem to spend much of their time flying through and through thorn bushes.[2]

Between Nuwára-Eliya and Hakgála, Ceylon, March, 1904, my attention was called to the curious habit of the male *Catophaga paulina*, Cram., of flying in strings as though tied together by an invisible thread. I witnessed this again at Haragáma, Ceylon, January 20th, 1908. Soon after mid-day large numbers of the ♂ were seen flying down the bed of the stream, sometimes in ones and twos, but often three, four, or five together in strings. On the same day clusters of a score or more were seen drinking at wet sand; when disturbed they would quickly come back to the favoured spots, as many as five to seven together, in strings, all conforming to the movements of their leader like wild geese.[3]

Melanitis ismene, Cram. (*leda*, Drury *nec* Linn.), is an insect which I have met with at divers times, and in divers places, but unfortunately have never come across it in any numbers. At the beginning of February, 1908, I twice witnessed its evening flight—at about 6.30 p.m. when it was nearly dark. My net-stick consists of two lower joints of a salmon-rod; on the occasion referred to the butt-joint, which is partly covered with cork, was lying near me on the ground. The butterfly flew in jerks, making short circuits and

[1] See above, pp. 190, 193.
[2] See above, pp. 57, 62, 73.
[3] See above, pp. 118, 370.

returning again and again to settle on my hat, my net, or the net-stick on the ground. It struck me at the time that it might probably be guided by the sense of smell, especially as it selected the part of my net-stick that was most handled. Yet it is quite possible that the butterfly was attracted by my white tropical clothing, and by the light colour of the cork, which was fairly conspicuous in the increasing gloom under the palms.

The Ceylon Papilios would appear to be more easily netted in the afternoon than in the morning; this is especially true of *Ornithoptera darsius*, Gray, and *P. parinda*, Moore.

P. demoleus, Linn., is swift of flight; so is *P. agamemnon*, Linn., which has a darting movement. The last-named is quite an inconspicuous butterfly whether on the wing or at rest, affording a marked contrast to the glorious *P. crino*, Fabr., which is startling in its almost luminous brilliance.

The flight of *P. hector*, Linn., is not especially swift, but is marked by the straightness of its course, seeming to keep on one level. Its black, white, and scarlet colouring is very obvious in flight, and the strong contrast of colours seems to make the movement of its wings more obvious and more rapid in appearance.

In marked contrast with the last is *P. aristolochiae*, Fabr., which sails about slowly and quietly with little obvious flapping of the wings; it moves in a stately way as if confident in its immunity from attack and is the most easily caught of all the group.

P. polytes, Linn., two of whose polymorphic females mimic *hector* and *aristolochiae* respectively, behaves very differently from them, and seems to trust much to swiftness of flight; my observations chiefly relate to the ♂, and I have an impression that the flight of the ♀ is slower, but this requires confirmation. "Though well known to Indian entomologists I am not aware that the contrast in flight between *polytes* and *aristolochiae* has yet been placed on record." Since this was written,[1] Prof. Punnett[2] and Col. Manders[3] have called attention to the differences between the flight of the three Swallow-tails, though they speak from a different point of view.

It is a notable habit with many Papilios that, when settled on flowers, feeding, they keep their wings in almost constant movement. This has been noted in all the following species:—*O. darsius*, which, when feeding, occasionally stops fluttering, dropping the fore-wings back (towards the abdomen); *P. parinda*, *P. hector*, *P. aristolochiae*,

[1] *Trans. Ent. Soc. Lond.*, 1909, p. 640.
[2] *Spolia Zeylanica*, vol. vii., part xxv., 1910, p. 7.
[3] *Proc. Zool. Soc. Lond.*, 1911, p. 714.

P. polytes, *P. agamemnon* (in which species the habit is very marked), *P. demoleus*, *P. demodocus*, *P. dissimilis* and *P. helenus*, f. *mooreanus*, Rothsch.

I was much struck by specimens of the last-named in the forest at Hatton, Ceylon (March 5th, 1908), settled on very dark-grey rocks drinking, with their wings about three-quarters expanded, but with the fore-wings drawn back so as almost entirely to conceal the conspicuous cream-coloured spot on the hind-wings. For the moment I thought that there was before me some other species, entirely black on the upper side.

P. sarpedon, Linn., f. *teredon*, Feld., and *P. jason*, Esp. (*telephus*, Feld.), do *not* flutter when drinking.

The exceedingly slow flight of sundry day-flying and almost certainly distasteful moths is referred to in many places in the earlier chapters.[1]

§ 8. Heliotropism.

Heliotropism, or the habit of turning towards the sun, is a phenomenon familiar to botanists.

Professor G. H. Parker appears to have been the first (1903) to describe what he terms "Negative Heliotropism" in the case of *Vanessa antiopa*, Linn., in the United States. He clearly establishes that when this butterfly after a flight settles in full sunshine, it does so with wings fully expanded, and then speedily so adjusts its position as to place the axis of the body as near as may be parallel to the sun's rays, with its head turned away from the sun. He records his numerous observations in great detail, and states that some species of the genus *Grapta* have the same habit. The object of the creature thus turning its tail to the sun is, he believes, to display its colouring to the greatest advantage.[2]

Some time after the reading of my first paper dealing with the subject[3] Professor Poulton called my attention to the following interesting observation by Mr. E. E. Green:—"*Melanitis ismene* is an adept at concealing itself. It usually pitches amongst fallen leaves where its form and coloration are sufficient concealment. But even on bare ground the insect is often extremely difficult to localize,

[1] See *e.g.* pp. 128, 195, 320, 391.

[2] *Mark Anniversary Volume*, Cambridge University, Mass., U.S.A., 1903, pp. 453–469. Prof. Parker gives a bibliography of the subject. I am indebted to Prof. E. B. Poulton, F.R.S., for this reference.

[3] *Trans. Ent. Soc. Lond.*, 1905, p. 136. Read, Dec. 7th, 1904.

though the approximate spot may have been carefully noted. I have watched the fly, immediately after pitching, alter its position so that its axis is directed towards the sun, thus casting no shadow."[1]

When in India in 1903 I several times noticed that when a butterfly with a cryptically coloured underside rested on a flat surface, the shadow cast by it was often far more conspicuous than the butterfly itself. Obviously, therefore, in such a case economy of shadow might afford considerable protection.

Now, near Simla, in October, 1903, when watching *Pararge schakra*, Koll., a butterfly resembling *P. megaera*, I noted three individuals in succession settled with their tails to the sun so as to reduce the shadow to a mere line. This was unfortunately just as I was leaving the district where the species occurred, but I did not observe any instances to the contrary. These observations were made quite independently of Mr. Green, and possibly at about the same time.

During my visit to Algeria in the spring of 1905, the subject of heliotropism was further investigated, and my results were communicated to the Entomological Society shortly after my return:—

> Following up my observations on the attitude at rest of *Pararge schakra*, made near Simla, in October, 1903, I paid a good deal of attention in February and March of the present year (1905) to *P. meone*, Cram., a butterfly that I found in varying numbers in all the parts of Algeria that I visited. This is either a Southern form of *P. aegeria*, Linn., or a closely allied species in which the yellowish spots are replaced by fulvous. It is fond of settling on sandy roads, rocks, walls, or the leaves of trees or shrubs, comparatively rarely visiting flowers. It first pitches, invariably I might say, with its wings about three-quarters expanded, and, almost always with its head turned away from the sun, the axis of the body being rarely more than 45° to either side. Immediately after settling it more often than not adjusts itself, by a quick movement, so as to make its tail point fairly accurately to the sun. After this adjustment, if at all, it closes its wings over its back, and as a necessary result its shadow is reduced to, or approximates to, a mere line. There can, I think, be no doubt that this habit is a great protection to the insect, since when resting on fairly flat surfaces the shadow of a Satyrine or Nymphaline butterfly with cryptic underside is often more conspicuous than the fly itself.

[1] "Notes on some Ceylon Butterflies," *Spolia Zeylanica*, vol. ii., pt. vi., 1904, p. 76.

I quote two cases from my notes:—

Feb. 8, Guyotville. Watched a specimen settle about twenty times. The wings were always at first expanded about three-fourths, an adjustment of its position was in most cases made immediately, and after that the wings were raised over the back. In about twelve individuals the orientation was perfect and the shadow a minimum; in seven or eight the orientation was imperfect, with a maximum error of about 45°, but usually much less.

Feb. 25, Biskra. Watched one settle three or four times, always with a shadow near the minimum.

Only one specimen of *P. meone* was ever seen to settle *facing* the sun; it did so three times, a fourth time turning its tail in the usual way. This was at Biskra on March 5th, and I noted at the time that the sun was not shining strongly. Two only were observed to settle with the axis of the body at right angles to the sun. One of these appeared to be crippled in the legs, since it alone always leaned to the same side. A third specimen, feeding on *Laurustinus* flower in the Chabet Gorge on March 18th, did not appear to orient itself by the sun.

In conclusion, except early in the day, or when the sun is dull, or when feeding on flowers, *P. meone* settles with the axis of the body turned so that its tail points more or less accurately to the sun; therefore, when the wings are raised, in the attitude of repose (as is more common towards the afternoon), the shadow is reduced to insignificant dimensions.

Pyrameis cardui, Linn., is an abundant butterfly in Algeria. It is not so easy to watch as *P. meone*, for it is a strong flyer and much more wary; moreover, many of the specimens were seen in exposed places during windy weather. Nevertheless, I can say confidently that it generally settles with its tail to the sun, though it does not do this with the regularity of *meone*. I saw two specimens turn their heads to the sun, and a third settle twice with its body axis at right angles, though the third time it settled normally. The first two freshly-emerged specimens, at Hammam R'ihra, March 25th, did not orient as well as those that had hybernated.

These observations confirm those of Professor G. H. Parker on *Vanessa antiopa*, Linn., and on a *Grapta* in the United States, and supply a reason for the habit that does not appear to have occurred to him, namely, concealment when in repose.[1]

[1] *Proc. Ent. Soc. Lond.*, 1905, pp. xxviii–xxix.

In the discussion which followed, Mr. C. O. Waterhouse suggested a third possible explanation of this habit, viz. that this special attitude exposed not only the wings, but the insect's body, most completely to the sun's rays. Doubtless we may fairly suppose that such an essentially sun-loving creature as a butterfly finds them agreeable.

I studied the matter further both in Devonshire and South Africa, and here quote the relevant passages of a paper on *Some Rest-Attitudes of Butterflies*;[1] merely adding by way of explanation that I have found it convenient to make use of the word *Orientation* and to speak of a butterfly with its tail pointed accurately towards the sun as *correctly oriented.*

After somewhat intimate acquaintance with *P. meone*, in Algeria, it was pleasant, in May, 1905, to study its Northern form, *P. aegeria*, which is common in and about my garden at Mortehoe, North Devon, and this was the more pleasant because our butterfly is undeniably more beautiful than its Southern sister.

I have notes on ten specimens observed, and it may be instructive to give them in detail.

May 3. Observed two *P. aegeria*; one settled several times with tail to the sun, the other was less particular.

May 9. Saw *aegeria* settled with wings open and tail directed towards the sun.

May 15. Saw one specimen of *aegeria* settle twice with fairly accurate orientation; another specimen settled first accurately oriented; then it settled again with the body nearly at right angles to, but with the head somewhat towards, the sun; thirdly, it settled again at right angles, but with its head turned to the opposite side.

May 19. Watched three specimens of *aegeria* and saw each of them orient itself accurately twice. The same day I saw another specimen orient itself four times.

My last observation was made on an *aegeria* within a few yards of my study window; this I disturbed many times with a view to noting its behaviour; out of seventeen occasions it oriented itself correctly but five times, it faced the sun once, but placed itself at right angles to its rays no less than eleven times.

The unusual behaviour of this butterfly gives strong proof that individual flies may differ much in behaviour, and as I should be disposed to describe it, in moral character. What entomologist who

[1] *Trans. Ent. Soc. Lond.*, 1906, pp. 97–106.

has sugared regularly in the same place has not observed among common *Noctuae* some individuals bolder and greedier than others?

I often saw *meone* settle on sandy roads, rocks, or walls, but the *aegeria* here referred to were for the most part settled on leaves, and the question of protection by economy of shadow could scarcely arise in their case.

The next subject of observation was *Pararge megaera*, Linn., which was especially interesting to me as nearly allied to *P. schakra*, the common Himalayan butterfly in which I first noted heliotropism in October, 1903.[1] The spring brood was not so numerous as the summer brood usually is, and only ten specimens were noted settled. Of these the first, a female, was watched on a Devonshire "dry ditch," settling for the most part on the rough slates of which it was built, that is to say, on surfaces not always well adapted for precise orientation. It was, however, observed to settle several times with its tail to the sun, and on one of these occasions it raised its wings over its back so that its shadow was scarcely visible, but two or three times it settled at right angles to the sun. Six other specimens were observed with their wings open, settled for the most part on flat ground, and all correctly oriented (one observed twice). Another specimen was first seen settled on the flowers of *Potentilla tormentilla*, Sibth., at right angles to the sun, but afterwards on *Scilla nutans*, Sm., correctly oriented. Yet two other *megaera* were seen settled, one on the road, the other on a flat stone, both with their wings closed up, correctly oriented, so as to throw practically no shadow.

The following note may be added:—

Mortehoe, September 14, 1907, late afternoon. *P. megaera* found asleep upon the face of a rock, about 3 feet above ground: its head up, antennae porrected but separated; wings in close contact; fore-wings drawn back so that no fulvous colour was exposed.

Mortehoe, August 24, 1911, 5 p.m. *P. megaera* at rest on a rock in deep shade. Attitude as in last paragraph.

Epinephele tithonus, Linn.—The following observations show that the habits of this butterfly, as regards orientation, are similar to those of *Pararge megaera*:—

Mortehoe, July 20, 1906. A specimen observed settled across the sun, with wings closed.

Same place and day. Another specimen seen to settle twice; oriented, with wings open.

[1] *Trans. Ent. Soc. Lond.*, 1905, p. 67.

Mortehoe, August 11, 1907. A specimen settled on the ground, oriented, wings three-quarters open.

Mortehoe, August 15, 1907. A specimen settled on grass; across the sun, wings closed. It was disturbed by a ♂ *E. janira*, it settled again and this time oriented and closed its wings, making no shadow.

Same place and day. A ♂ settled on a leaf, oriented, wings open.

Same place and day. A ♂ seen to settle three times on leaves, with wings open; twice it faced the sun and then partially adjusted itself; the third time it oriented correctly.

Same place and day. A ♂ settled on grass, oriented, wings half to fully open.

Same place and day. A ♀ on a bramble leaf, oriented, wings three-quarters to fully open: it was twice observed to close its wings, leaving little shadow; the eye-spot on the fore-wing was exposed.

Same place and day. A ♂ on a leaf of *Heracleum*, wings three-quarters open, oriented; it momentarily closed its wings, leaving no shadow.

Same place and day. A ♂ on a bramble leaf, oriented, wings three-quarters open.

Same place and day. A ♂ on a bramble leaf, wings quite open, imperfectly oriented.

Same place and day. A ♀ twice seen settled across the sun, wings closed, but eye-spot visible.

Mortehoe, August 22, 1907. A ♀ oriented, wings three-quarters open.

Mortehoe, August 24, 1907. A ♂ half-oriented.

Same place and day. A ♀ on a leaf, imperfectly oriented.

Epinephele hyperanthus, Linn.—This is a restless butterfly, and takes long to settle; however, I have this note:—

Mortehoe, July 20, 1906. Four *E. hyperanthus* seen to orient, with wings three-quarters open.

During May, 1905, hybernated specimens of *Vanessa io*, Linn., were unusually common at Mortehoe, and the attitudes of at least fifteen different individuals were noted on seven different days. Of these, eleven, or three-fourths, oriented themselves correctly so as to turn their tails to the sun. Of the minority, the one-fourth that settled otherwise than with tail to the sun, two were settled on the flowers of the Wild Hyacinth or Blue-bell (*Scilla nutans*), and of these one was facing the sun. A third specimen, settled on flowers

of Lilac (*Syringa persica*), appeared to be quite indifferent to the sun's direction. The fourth was at first settled facing the sun, but it very soon moved, settled again, and at once adjusted its position so as to be perfectly oriented with tail to the sun. I subsequently watched the same butterfly settle three times, the first time with tail turned to the sun correctly, but the second and third times it alighted on Blue-bells and did not orient itself.

Vanessa urticae, Linn., was far less common and only two specimens offered themselves for observation, of which the first was twice seen to adjust itself to correct orientation, but the second, on the same Lilac bush with the *V. io* mentioned above, appeared, like it, to be indifferent to the sun's direction.

From the preceding observations it may fairly be inferred that *Vanessa io* (and probably also *V. urticae*) when settled in full sunshine, except sometimes when feeding on flowers, habitually places itself so that its tail is directed towards the sun. As however the butterflies were not seen to close their wings over their backs nothing can be said as to the shadow question.

The next species that came under my notice was *Melitaea aurinia*, Rott., which was very abundant in a restricted North Devon locality. All the specimens observed were settled on flowers or low plants; in the great majority the wings were fully expanded, though a few had the fore-wings drawn back so as to form an approximation to the Deltoid shape. In order to secure perfect fairness my method was to record the position of *every* specimen seen so long as the sun was shining brightly. Three series of observations were thus made, with the following results:—

	First series.	Second series.	Third series.	Total.
Tail to sun	13	29	69	111
Side to sun	2	6	9	17
Head to sun	1	2	0	3

Adjustments after settling were often noticed, occasionally repeated adjustments. When there was a wind they settled at first with their heads to it, one butterfly succeeding in orienting itself only after much struggle. When the sun was not shining they were often noted settled at right angles to its direction.

Under the circumstances in which this local butterfly, *M. aurinia*, occurred, it is difficult to see that the amount of shadow thrown could have been of any moment, though doubtless its colours would show up more if the undersides of the hind-wings when at rest had the sun shining directly on them rather than tangentially.

Observations in South Africa, 1905.

The visit of the British Association to South Africa gave me more extended opportunities; it gave me moreover the advantage of Dr. F. A. Dixey's co-operation, which was the more valuable by reason of his extraordinary patience in observing and minute accuracy in recording results.

Eurytela hiarbas, Drury, is a Nymphaline butterfly, with a very Satyrine aspect and habits not unlike those of *P. aegeria*. It is common in woods round East London and Durban, affecting partial shade. At East London I saw it in a small wood within 100 yards of high-water mark. It does not seem to be attracted by flowers, but moves about bushes with a slow gliding flight; it may settle on leaves, or on the ground, the wings being commonly three-fourths expanded, though sometimes more fully. When thus settled the wings are often slowly shut in part and again opened, though I never saw them quite shut. On at least three several days they were noted to have their tails turned to the sun, but the orientation was imperfect, often 15°–30° out, and occasionally they settled with the body axis at right angles to the sun.

Precis clelia, Cram., is a Nymphaline butterfly that is common and widely distributed in South Africa. The dark upper surface of the wing is rendered very conspicuous by white spots near the tip of the fore-wing and a large blue spot on the hind-wing, but the underside is marbled with shades of light grey and is very quiet and unobtrusive. As regards its habits I cannot do better than quote Dr. Dixey's very graphic account of its behaviour as observed in the Old Cemetery, at Sydenham, near Durban, in the middle of August:—

> Common at one spot in the cemetery. It has a habit of flying a little way, sometimes in pursuit of another butterfly, making a round and returning to the same, or nearly the same place. It settles on the ground, or on a low plant, nearly always turning its back to the sun, and often closing its wings over its back. I saw one settle at right angles to the sun, casting a broad shadow; but as there happened to be several objects close by casting similar shadows, it was not very conspicuous. Presently the same individual flew up and settled down again, this time on a bare piece of earth and with its back to the sun in the usual way.

Another note, also relating to Sydenham, is:—

> *P. clelia* seen to settle, and then rapidly turn its back to the sun; it did not close its wings. *P. clelia* seen here seems *always* to turn its back to the sun.

To Dr. Dixey's description I would add that the wings are usually about three-fourths expanded, nearly as with *Vanessa atalanta*, Linn., at home. One specimen was observed to settle with tail to the sun five consecutive times. It was only occasionally that I saw them close their wings over their backs, when the shadow was reduced to a minimum, but I did observe this several times, both in the neighbourhood of Durban and at the Victoria Falls. As a rule *P. clelia* seemed to pitch correctly, but now and then it was seen to adjust itself.

Precis cebrene, Trim., is another common and widely distributed South African butterfly. Though very differently coloured from *P. clelia*, it is nearly, though not quite, as conspicuous when the upperside is displayed, but the almost uniformly clay-coloured underside is scarcely distinguishable against certain backgrounds, such as sand, clay, or rock of a grey or yellow tint. It is fond of frequenting dry spruits, or watercourses, settling on the rocks or boulders, but in the Zambesi country Dr. Dixey often saw it settle in trees. It was repeatedly observed to orient itself fairly accurately, but did not appear to close its wings as often as *P. clelia*. A note made by me at Ladysmith, August 26th, says:—

> Oriented within about 10°–15°; settled often upon cliffs of yellow sand or mud on which it was moderately conspicuous. One specimen was repeatedly observed to close its wings, its shadow was then near the minimum and the insect inconspicuous.

Precis natalica, Feld., a rather dingy species, though generally distributed, was much less common than the two preceding. It is somewhat of a shade-lover and usually settled on the ground or on a leaf, its wings more spread than *clelia* or *cebrene*. Except when settled in the shade its tail was directed towards the sun. One was seen to close and open its wings, another was watched for some time and observed over and over again to orient itself correctly, and twice to close its wings so as to leave practically no shadow.

Precis elgiva, Hew., is not uncommon in woods near Durban, it was noted as sitting with wings fully expanded and tail to the sun.

Precis sesamus, Trim., is a dark, handsome insect, fond of hiding itself in ditches and under dark banks, often several together; this

is not always done with a view to seek shelter from the wind, though sometimes that seemed to be the object. It pitches on or close to the ground, with the wings fully expanded, just as *P. natalica*; in this position it is less conspicuous than might be supposed, especially when it settles on dark clay, or peaty soil, as it appeared to be fond of doing. Both Dr. Dixey and I saw it orient itself like its congeners, sometimes with adjustment. On one occasion only did I see it close its wings over its back, casting, as a result, a minimum shadow.

Another *Precis*, nearly the colour of the red soil, but more orange in tint, was observed to orient with tail to the sun. This I saw several times but failed to catch; it was on August 18th, on somewhat open ground at the edge of a large banana garden above the Congella Woods, Durban. I thought at the time that this was *P. octavia*, Cram., the wet-season form of *P. sesamus*, but it is just possible that it may have been *P. cloantha*, Cram., which I took on the other side of Durban. With the possible exception of this doubtful *Precis* all my remarks about South African butterflies apply to dry-season forms.

Hamanumida daedalus, Fabr., is a common African Nymphaline that we only met with on the banks of the Zambesi. We both noted that it usually flies near the ground, on which it settles with the wings closely appressed to the surface. It occasionally flaps its wings, but as long as they are still it is very inconspicuous, its grey colour approximating closely to that of the sand, the whitish spots aiding its concealment by breaking up the surface. One was observed to walk about on mud regardless of the sun's direction, but it finally settled down with tail to the sun and wings spread out in the usual way.

[*Abisara* (*Zemeros*) *flegyas*, Cram., a common Oriental Erycinid, has a strikingly similar pattern to the last-named Nymphalid, but I do not know what its favourite resting-places are.]

Pyrameis cardui, Linn. I summed up my observations on this butterfly in Algeria in the following words:—

> I can confidently say that it generally settles with its tail to the sun, though it does not do this with the regularity of *Pararge meone*. I saw two specimens turn their heads to the sun, and saw a third settle twice with its body at right angles, though the third time it settled normally.[1]

At Durban, on August 21st, I watched this cosmopolitan butterfly orient, but full weight must be given to the following very definite observation of Dr Dixey's when watching lizards:—

[1] *Proc. Ent. Soc. Lond.* 1905, p. xxix.

Ladysmith (North East Defences), August 27th. Watched several *P. cardui*, which settled frequently. They would settle at any angle with regard to the sun, but perhaps rather more often with back to it. They fanned their wings, and often shut them up tight (keeping them so for some time) in *any* position with regard to the sun.

This was late in the afternoon, but I do not gather from Dr. Dixey (nor from personal recollection) that the sunlight was feeble, or that there was a strong wind, or that the butterflies were feeding or drinking—all disturbing causes. There can, I think, be no doubt that the habit of heliotropism is not as fixed in the Painted Lady as in many Nymphalines.

That this butterfly, often at any rate, *does* orient, is clearly proved by subsequent experience. In Egypt, in 1909, I saw many *P. cardui*, and find these notes:—Pyramids, January 4th, *P. cardui*, seen to orient twice. Aswân, January 23rd, *P. cardui*, abundant; many oriented. Aswân, February 25th, *P. cardui*, abundant; many specimens fresh, but chipped; several seen to orient—practically all those seen settled on the ground.

Again, in the Botanical Gardens, Hobart, Tasmania, *P. cardui*, f. *kershawi*, McCoy, was seen to orient twice.

Among our notes on heliotropism there are but three references to Pierines. The first is interesting as tending to negative the suggestion that the purpose of heliotropism is to mimimize the butterfly's shadow and so aid in its concealment. Dr. Dixey writes:—

Durban (The Bluff), August 16th. *Teracolus ione*, Godart (*speciosus*, Wallgr., *jobina*, Butl.), ♂. When first seen it was settled in the sunshine with wings expanded; then it flew a short distance and settled on a reddish sandy path. Cloud came over the sun, and the butterfly closed up its wings, so that only the hind-wing and tip of the fore-wing were visible.

In explanation of this note Dr. Dixey emphasizes the fact that in the dry-season form of *ione*, the underside of the hind-wing and the tip of the fore-wing are reddish, hence the tightly closed attitude is cryptic on red soil.[1] He adds that doubtless when the butterfly

[1] The observant traveller must have been struck by the prevalence of red soils in tropical countries. The two following notes on the origin of red soils may be of interest to the entomologist:—

Mr. R. D. Oldham, F.R.S., of the Geological Survey of India, writing of the Basal Carboniferous Conglomerate of Ullswater, says: "The red colour of the fine-grained material suggests tropical or subtropical conditions, as the formation of red

contemplates a long stay (as at night, or when the sun goes behind clouds) the closed-up attitude is adopted to take advantage of its *cryptic colouring, and not to minimize its shadow.*

The other observations were made on *Belenois severina,* Cram., a white butterfly that we found very abundant at Durban.

Dr. Dixey says :—

> *B. severina,* ♂ and ♀; when clouds come over the sun, this species generally settles on a grass stem, and, closing its wings tightly, becomes part of the picture. It certainly generally turns its back to the sun when it settles in sunshine, and then does not often close up its wings.

My note is as follows :—

> *B. severina,* 2 ♀ seen to settle *across* the sun, early in the day. Late in the afternoon many ♂ *severina* seen settled with wings three-quarters open, and tail more or less to the sun; but where much exposed to wind the wings were closed and the head turned to the wind, so as to be almost across the sun.

It is worthy of remark that throughout all these observations of heliotropism, I cannot recall a single case in which an adjustment, or subsequent movement of the butterfly after pitching, tended to throw it out of orientation. Hence it is fair to assume that if the insects had been watched longer after pitching positive results would have been observed in a larger proportion of cases.

But, be that as it may, beyond doubt it is a habit with a number of butterflies, especially Nymphalines, to settle with their tails to the sun. Whether they do this, as Professor Parker supposes, to *display their charms to the greatest advantage,* or whether the first impulse was given by the light or warmth of the sun's rays, I am unable to determine, but that in such species as *Pararge megaera*

soils is at the present day so much more common in tropical than in temperate regions that it may almost be regarded as a characteristic of a hot climate."—*Geological Magazine,* 1900, p. 564.

Again, Mr. J. J. H. Teall, F.R.S., speaking of the Keuper Marl, etc., at Sidmouth, said that he thought "that the red colour of the formation was mainly due to the sub-aërial decomposition of rocks containing ferriferous compounds, under conditions similar to those prevailing at the present day in India, the Southern States of Eastern North America, Brazil, and parts of Africa, in short, to what might be termed the lateritic type of decomposition. Under this mode of decomposition the iron becomes oxidised, and deposited as a coating on the grains of quartz and other undecomposed minerals. The red material thus produced would mantle the slopes, fill up the hollows, or be spread out as flat fans over the low ground by torrential action. It would also be deposited in lakes, lagoons, or seas."—*Proceedings of the Geologists' Association,* July, 1899, p. 141.

and *Precis clelia* the diminution of the shadow when the wings are closed helps to conceal the butterflies from their enemies I have no longer any doubt.

Further observations will show how far the habit is general within the families in which it has been observed, and whether it prevails in other families.

In the discussion which followed the reading of this paper (March 7th, 1906), the President (Mr. F. Merrifield) threw out the suggestion that possibly the object of negative heliotropism might be to enable the butterfly to *see* to the greatest advantage. This is in agreement with Mr. Marshall's remark that orienting butterflies are always very much on the alert.

Dr. T. A. Chapman said that the heliotropic attitude, with tail to the sun, was familiar to observers of Vanessas and other Nymphalines, and some other butterflies of the European fauna. During their active period, when settling, usually on the ground, the butterflies in question assumed that orientation, and spread their wings flat on the ground with the head a little raised, making the greatest display of their colours, but chiefly appearing desirous to secure as vertical a sun as circumstances allowed; this might be different in the tropics.[1]

To this explanation Professor E. B. Poulton advanced an objection, that when the orienting butterfly closed its wings the exposure of both body and wings to the sun's rays is reduced to a *minimum*.

Observations in the W. Indies, 1906–7.

Constant Spring, Jamaica, January 8th, 1907. *Precis lavinia,* Cram., f. *zonalis,* Feld. Not uncommon, but hard to catch; usually settled on the ground with wings open; seen to orient and to put its wings up, causing little shadow; seen also to adjust itself after settling, so as to make the orientation more perfect; but sometimes seen to face the sun.

Maraval, Trinidad, December 19th, 1906. *Anartia amalthea,* Linn. Flies near the ground; settles with wings three-quarters open; orients, but not always.

Same place and day. *Anartia jatrophae,* Linn. Has a ghostly flight; settles on the ground; orients.

Colon, Panama, December 28th, 1906. *A. jatrophae.* This species orients, but not very regularly.

[1] *Proc. Ent. Soc. Lond.*, 1906, p. xxvii.

Constant Spring, Jamaica, January 3rd, 1907. *A. jatrophae*. Orients, but not very accurately; often closes its wings, and is then very cryptic among whitish dead grass.

Same place, January 5th. *A. jatrophae*. The commonest Nymphaline: flies fast, close to the ground, looking very white. Usually settles on the ground or close to it; does not frequent flowers much; settles with the wings fully expanded, but often closes them over its back. Orients, but not accurately. Has, however, been noted with its wings up facing the sun; also once or twice across the sun.

Ramble, Jamaica, January 24th, 1907. *A. jatrophae*. Orients.

Montego Bay, Jamaica, February 2nd, 1907. *A. jatrophae*, seen twice to settle on the whitish sand of the seashore, to orient and close its wings, making no shadow.

Port Antonio, Jamaica, March 4th, 1907. The sun nearly vertical. *Victorina stelenes*, Linn., settled on leaves, once facing the sun, once head downwards, tail to the sun, wings closed and no shadow.

Ramble, Jamaica, January 24th, 1907. *Cystineura dorcas*, Fabr. Flies very slowly, close to the ground. Settles with wings nearly wide open, but it sometimes closes and then quickly re-opens them. When feeding on flowers, especially the Composite, *Bidens leucanthus*, W., it is indifferent as to its position with regard to the sun, but otherwise it usually orients, though it occasionally faces the sun.

Observations in Ceylon, 1908.

Precis iphita, Cram. This species was often observed. It most often settled with its wings closed, but frequently they were fully expanded. Though one specimen was seen to settle twice across the sun, it more usually either faced the sun or turned its tail to it.

Vanessa haronica, Moore. One seen to orient with its wings closed.

Yphthima ceylonica, Hew. This species, which keeps close to the ground, settled occasionally with the wings open, more often half open, but most commonly closed. As regards orientation, it was noted to have its tail to the sun ten times (once by adjustment), as against seven times that it was across the sun.

Ergolis taprobana, Westw., and *E. ariadne*, Linn. These may be conveniently taken together. They have a skimming or gliding flight which is not always checked by rain. They settle commonly with

their wings fully expanded, but sometimes close them only to open them again. Most often they orient, but sometimes imperfectly; one was seen to adjust itself.

Nissanga patnia, Moore. This butterfly settled with its wings up (one exception) and, so far as I observed, with the eye-spot exposed. In the majority of cases it oriented.

Neptis jumba, Moore; *N. varmona*, Moore; and *Rahinda sinuata*, Moore. These three species may be conveniently taken together. They all have the same gliding flight and all settle most frequently with the wings fully expanded, though often closed. As regards orientation less than half the specimens observed appeared to pay any attention to the direction of the sun's rays, though one *varmona* was certainly seen to adjust its tail to the sun.

Castalius rosimon, Fabr. Two specimens seen to orient with wings up.

Observations in England.

Argynnis paphia, Linn. Mortehoe, 1907, and later. I have several times seen this butterfly orient.

Lycaena corydon, Fabr. Berkshire Downs. I once saw this orient.

Lycaena icarus, Rott. Mortehoe. The constant habit of this species is to orient with the fore-wings set further from the hind-wings than in most butterflies.

Hesperia malvae, Linn., and *Thanaos tages*, Linn. Both orient habitually.

§ 9. "List" and Shadow.

"List" may be exactly defined as an attitude resulting from a rotation of the insect about its longitudinal axis, as heliotropism results from a rotation about an imaginary vertical axis at right angles to this. Heliotropism corresponds to the movement of a vessel in answer to the helm. Most vessels, independently of wind, waves, or tide, have a tendency to lean somewhat to one side or the other; this inclination is termed by sailors "a list," and, although I am aware that the analogy is not quite close, since the insect may lean at one moment to one side, at another to the other, I shall for brevity term such an inclined or tilted position *a list.*

So far as I know, this list was first observed by Col. C. T. Bingham, in 1878, in a *Melanitis*, but the observation was not

published till long afterwards. The extracts from his diary of that year, brought to light by Prof. Poulton, give a most vivid description of some phases of the struggle for existence as it may be seen in a tropical forest. Col. Bingham says:—

> The *Melanitis* was there among dead leaves, its wings folded and looking, for all the world, a dead dry leaf itself. With regard to *Melanitis*, I have not seen it recorded anywhere that the species of this genus when disturbed fly a little way, drop suddenly into the undergrowth with closed wings and invariably lie a little askew and slanting, which still more increases their likeness to a dead leaf casually fallen to the ground.[1]

E. H. Aitkin's papers in the *Times of India* reappeared in 1894 as "A Naturalist on the Prowl." His description of this habit of *Melanitis* has been already quoted (p. 75, *supra*). Dr. Dixey called my attention to this passage (as he has to so many other things), and to the similar habit of *Satyrus semele*, Linn. In the summer of 1903 we watched many specimens of the latter butterfly at Mortehoe, and found that, as a rule, they settled on the ground "in three motions": —(1) the wings are brought together over the back; (2) the fore-wings are almost completely drawn between the hind-wings; (3) the whole is thrown over to right or left (indifferently), to the extent of 30° or 40° or even 50°. I have observed that in confinement the third movement sometimes precedes the second. It is remarkable that the creature seems to attach more importance to this tilt or list when settled in sunshine than in shade. Of this I feel assured from observations on the butterflies confined in a large paste-board box covered with a piece of glass. *Epinephele jurtina*, Linn., and *E. hyperanthus*, Linn., similarly observed in confinement, are also often seen out of the upright, but the list in their case does not exceed 15° to 20°. In confinement I have once observed *Pararge aegeria*, Linn., and *P. megaera*, Linn., sitting with a list of about 25°.

My Indian experience (1903) enabled me to add three species to the "listing" butterflies:—*Mycalesis indistans*, Moore, slight list; *Hipparchia parisatis*, Koll., 20° to 30°; *Aulocera swaha*, Koll., 45° to 50°. In the last-named species the same individuals were observed sometimes to go over to the right, sometimes to the left; one was seen to make three efforts, getting further over each time. A specimen of *H. parisatis* was observed *walking about* with a list of 20°.

[1] *Trans. Ent. Soc. Lond.*, 1902, p. 363. All the extracts there given deserve the most careful study.

To these observations I may add that at Yokohama, May 19th, 1904, *Blanaida goschkevitschii*, Möschl., a Satyrine like a large *P. megaera*, was observed with a list of 40°.

At this stage the conclusion reached was:—

> There is no doubt that this sideways attitude makes the insects less conspicuous when resting on a flat surface, but I have satisfied myself from observations on English Satyrids that the attitude is more often adopted by the butterflies when sitting in sunshine than in shade. Now if the list be away from the sun the shadow would be increased, but if towards the sun it would be diminished, in some cases even to extinction. Numerous observations are required to determine whether the list has any relation to the sun's position. I would, however, remark that in the case of a butterfly with cryptic colouring on the underside the shadow is often far more conspicuous than the butterfly itself, as I frequently observed in India. Obviously, therefore, economy of shadow might be a considerable protection.[1]

Observations in South Africa, 1905.

On the voyage out to South Africa the usual call at Madeira gave us little more than a glimpse at its butterflies. The local race of *Satyrus semele*, Linn., was common on the Caminho do Meio at an altitude of about 800 ft., and Dr. Dixey has this note:—

> Settled on the ground, low herbage, walls and tree-trunks. The fore-wings are depressed with a snap as in the English *semele*. Two were specially noted settling in sunshine (not strong) both turned head to sun and listed—one to port and one to starboard.

My note is:—

> A specimen seen settled head to sun, list 30° to starboard.

It was of course only to be expected that on the fifth day from leaving Southampton we should both use nautical phraseology.

South Africa contributed little to increasing our knowledge of the list. The genus *Pseudonympha*, somewhat suggestive of *Erebia*, is characteristic of Cape Colony; at East London I observed several *P. cassius*, Godart, at rest, but did not see any list.

Mycalesis safitza, Hew. Though I took many odd specimens of

[1] *Trans. Ent. Soc. Lond.*, 1905, pp. 135, 136.

this dingy butterfly, I never found it really common, and have but two notes of its resting attitude:—

Berea, near the hotel, Aug. 14th, seen to settle in the shade, wings upright.

And,

Congella, Aug. 18th. This species does not appear to orient: a slight list *away* from the sun, but sun not very bright at the time of observation.

Dr. Dixey, however, obtained more positive results:—

Durban (Botanic Garden), *Mycalesis safitza* has a very strong list when settled in the open; it may be to right or left in the same individual.

Durban (Botanic Garden), saw *Mycalesis safitza* settled on bare ground; it had a strong list to the left. Saw it fly and settle in bright sunshine; once with its back to the sun, with list to left; once with head to sun, right list; once at right angles to sun, throwing a broad shadow.

It would therefore seem that *Mycalesis safitza* may be included among the Satyrs with a list, but this does not appear to help concealment by diminishing the shadow, as I had suggested would be the case if the list were towards the sun.

Observations in Jamaica, 1907.

My visit to the West Indies enabled me to determine that at least one Neotropical butterfly, also a Satyrine, is to be counted among the "listers."

Calisto zangis, Fabr.—This is quite a shade-loving butterfly; it keeps close to the ground, flying amongst herbage, usually for a very short distance at a time. It was once seen flying freely on a rainy day.

Mackfield, Jamaica, January 29th, 1907. Three *C. zangis* seen to settle (one of them twice) with a list away from the sun of about 30° from the vertical.

Christiana, Jamaica, February 2nd. *C. zangis* seen to list away from the sun.

Mile Gully Mt., Jamaica, February 14th. *C. zangis* seen to settle and then, with a jerk, list about 30°.

Port Antonio, Jamaica, March 4th. Three *C. zangis* seen to list from the sun, usually but 20° to 30°; one was seen to increase the list by two movements.

During my visit to Ceylon in the spring of 1908 I did not see any butterflies list.

In his "Butterflies of British India" (vol. i., 1905, p. 47) Col. Bingham writes: "The *Satyrinae* are shade-loving insects; most of the forms have comparatively a weak flight, and frequent the undergrowth, long grass, or dense evergreen forests. Many are cryptically coloured on the underside, and their method of suddenly dropping after a short flight, and resting all askew, heightens their likeness to dead or decaying leaves casually blown down." It is greatly to be regretted that considerations of space prevented the author from giving us more such information from his stores of knowledge.

I now give some later observations on "list" in English Butterflies.

Coenonympha pamphilus, Linn.—Early in June, 1906, Mr. W. J. Kaye told me that he had recently noted in Surrey, *C. pamphilus* settled with its wings up, but leaning over in such a way that the sun's rays fell vertically upon its wings. This was a new idea to me. Going down to Devonshire the next day I naturally wished to confirm Mr. Kaye's observation, but though I have seen the butterfly in some abundance at Mortehoe, its appearance there is uncertain, so much so that neither in 1904 nor in 1907 did I come across a single specimen in the parish. However, in 1906 I succeeded in finding three specimens, which I observed with the following results:—

Mortehoe, June 10th, 1906. *C. pamphilus*: a specimen seen to settle six times; always across the sun; with head sometimes to the right, sometimes to the left; the wings up; in every case with a list away from the sun so that its rays were about normal to the wing surface.

Mortehoe, June 13th, 1906. A specimen seen to settle several times; across the sun; the wings up, but with no list.

Mortehoe, June 14th, 1906. A specimen seen to settle sixteen times; always with wings up and across the sun; on twelve occasions with a list away from the sun.

Braunton Burrows, September 10th, 1907. *C. pamphilus* (the only one seen that year) settled across the sun, with head to the wind, and a list away from the sun.

Morte Point, September 5th, 1908. *C. pamphilus* rather common at one spot; the wind was so strong as to compel them to keep their heads to it regardless of the sun. A specimen was seen

to list three times to the right, slightly, and once to the left, strongly.

Satyrus semele, Linn.—The behaviour of this butterfly may be compared with that of the last-named.

Mortehoe, July 20th, 1906. A number of *S. semele* observed to settle. All put their wings up; two oriented with tail to sun; one faced the sun; twenty-four placed themselves across the sun, of these one was noted as listing about 30° towards the sun, but eight listed away from the sun, only one, however, to an extreme degree.

Same place and day. Three *S. semele* put into a large glass-covered box. Observed the same afternoon, at 6 p.m., in sunlight; all three were sitting across the sun and listed away from it 35°, 45°, and 55° respectively.

Mortehoe, July 31st, 1906. Several *semele* noted, settled across, and tilted a little away from the sun.

Mortehoe, August 22nd, 1907. Three *semele* observed at rest, all across the sun, and listed away from it 30°, 40°, and 25° respectively.

Lundy Island, August 27th, 1907. A *semele* listed away from the sun about 50°.

Here I may insert an observation made by Mr. E. G. Waddilove at Bournemouth in the autumn of 1906:—

"A Grayling settled on a patch of bare black peat-earth, shut up its wings vertically and crawled at once some two yards to the edge of the patch to where some fir-needles, a cone or two, and a few brittle twigs were lying, and then becoming stationary threw itself over at an angle of some 45° square to the sun. It thus became quite indistinguishable from its surroundings." (From a letter to the author.)

The late Mr. C. G. Barrett, in an admirable account of the habits of the same butterfly, wrote as follows:—

"... it even seems to lie down sideways, or at any rate to so greatly slope its closed wings as to appear prostrate." [1]

Epinephele janira, Linn.—Our commonest butterfly is especially interesting, since its habits are irregular and partake of those of *C. pamphilus* and *S. semele*.

[1] "Lepidoptera of the British Islands," 1893, vol. i. p. 85.

Mortehoe, July 20th, 1906. *E. janira.* Four specimens oriented; of these, three had the wings open, one closed. Eleven specimens were settled across the sun, with wings closed; certainly one of the latter listed from the sun.

Mortehoe, July 30th. Some noticed to orient; others sitting across the sun.

Mortehoe, August 11th, 1907. One ♂ and two ♀ oriented; wings three-quarters open. Others were seen across the sun and one of these listed. The wind was, however, this day too strong for trustworthy observations. The butterflies mostly sat head to the wind.

Mortehoe, August 15th, 1907. Several specimens noted settled on grass, on or near the ground. Of these three ♂ oriented, one with the wings quite open, the other two three-quarters open. A ♀ oriented with the wings open; another ♀ settled on a leaf oriented with the wings three-quarters open. Another ♀ sat across the sun, had its wings up, and listed away from the sun. The eye-spot on the fore-wing was sometimes obscured, sometimes in part visible.

Mortehoe, August 16th, 1907. A ♀ seen to settle three times across the sun, with its wings closed, leaning away from the sun. Yet another ♀ was seen to settle three times; twice across the sun, with wings closed, but on the third occasion with its wings open and fairly oriented.

Mortehoe, August 22nd, 1907. A ♀ observed to settle three times, (1) oriented; (2) across, with slight list away from the sun; (3) oriented.

Mortehoe, August 24th. A ♀ settled on a leaf oriented.

The effect of a list on the shadow.

It is worth while carefully considering the precise effect of a list on the shadow of a butterfly sitting with the axis of its body at right angles to the sun's rays.

To make the matter clear I have constructed three diagrams. The diagrammatic butterfly is in each figure supposed to be settled with its tail towards the observer, but turned somewhat to the left so as (in two of the three diagrams) to expose the underside of the right wings obliquely to the observer. The sun is supposed to be to the right of the observer and nearly to the right of the butterfly. The sun's elevation is taken to be 50°, representing a condition that

is fulfilled in Europe during some part of every day near midsummer, and *in the tropics during some part of* every day *in* the year.

When the butterfly is upright its shadow is nearly as long as its wings, and is fully exposed to view (see Fig. 16).

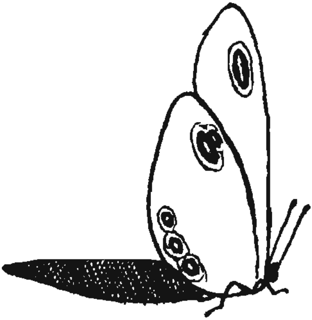


FIG. 16.—Shadow of butterfly—upright.

If the butterfly were to list towards the sun its shadow, still fully exposed to view, would diminish until the list became equal to the sun's altitude, when there would be no shadow. In this position, moreover, its wing surfaces would be least illuminated.

Supposing the butterfly to increase its list; this would bring the sun's rays on to the under surface of its left wings and so throw

FIG. 17.—Shadow of butterfly—listing 65° towards sun.

the shadow to the right, or towards the sun (see Fig. 17). The shadow would continue to increase in length until, when the butterfly's wings touched the ground, it would equal them in length. On the other hand, as the shadow increased in length it would be more and more concealed from view.

But as a matter of fact, the list has almost always been observed to be *away* from the sun. Such a list increases the length of the shadow until the list amounts to 40° (under the conditions assumed) and so brings the wings into a position normal to the sun's rays (see Fig. 18). The length of the shadow is then at its maximum and longer than the wings.

A further list would diminish the shadow until, when the wings touched the ground, it would equal their length.

A little consideration will, however, show that by listing the butterfly, so to say, covers up its own shadow more and more, so that while a slight list produces little effect on the shadow, a considerable list—45° and upwards—would make the shadow less conspicuous than that cast by the same butterfly in the upright position.

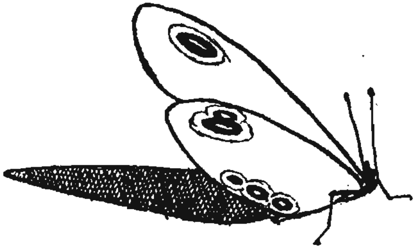


FIG. 18.—Shadow of butterfly—listing 40° from sun.

My conclusion accordingly is that, so far as regards the shadow cast, no list *from* the sun can be protective to the insect unless it be extreme. Again, a list *from* the sun, by resulting in the maximum illumination of the wing surface, can hardly aid concealment. At the same time, it cannot be denied that a butterfly by placing itself out of the upright, may thereby be protected in so far as it may then be more difficult to detach it from its surroundings. This would certainly appear to have been the case with the *Melanitis* recorded by Col. Bingham and by "E. H. A.," also with the *S. semele* observed by Mr. Waddilove.

Barrett's remark as to a rarer British butterfly, *Grapta c-album*, Linn., deserves quotation :—

". . . fond of sunning itself in roads, on warm walls, or on the ground upon dead leaves in sheltered valleys. Here if the

sun becomes overclouded, it will sometimes close its wings and almost lie down, in such a manner that, to distinguish its brown and green marbled underside from the dead leaves is almost impossible."[1]

Here Barrett says *if the sun becomes overclouded,* but I have observed the list (in other butterflies) during bright sunshine only.

It will be remembered that Prof. Parker (p. 539, *supra*) states that some American species of the genus *Grapta* orient themselves, so that it would appear that both heliotropism and list occur in the same genus.

When my attention was first drawn to the subject of heliotropism by observing the habits of *Pararge schakra*, Koll., in the Simla district in October, 1903, I was disposed to associate that habit with list, and suggested that both had probably been selected, since they appeared to assist to a notable degree in the concealment of the insect from its foes. The evidence now available is more ample, though still far short of what would be requisite to establish definitely any explanation.

Prof. Parker's explanation that by negative heliotropism the insect displays its colouring to the best advantage, can scarcely be applied to list, for while it may be true that by listing a butterfly displays its underside, that underside *is* in listing butterflies usually cryptic, even when in our cabinet it appears the more brilliant of the two. Moreover, in the listing position the most conspicuous feature of the pattern is often concealed by the hind-wing, so that the listing butterfly exposes to the sun *one* hind-wing only, and a small portion of the corresponding fore-wing.

That under special circumstances there is an economy of shadow in both heliotropic and listing butterflies is unquestionable. On the other hand, the negatively heliotropic butterfly with wings expanded, and the listing butterfly with wings closed, both place their wings as nearly as may be normal to the sun's rays, exposing in the one position their upper, in the other their under, surface. Is it possible that the direct rays of the sun, falling normally on either surface of the wings, afford a pleasurable sensation to the insect? Or is the exposure of the insect's *body* to the sun, common to some extent to both these attitudes, the end obtained? The obvious love of most butterflies for hot and sunny corners unquestionably suggests some such explanation. Perhaps the two explanations may both be true, —that heliotropism and list combine the pleasures of isolation with

[1] *Op. cit.*, p. 125.

the minimum of risk. As far as the evidence at present available goes this explanation commends itself as the most probable.

Dr. Chapman tells me that he has observed a marked list in a Spanish species of *Erebia*, and my own experience of list is confined to the Satyrines, a group of feeble flyers, be it noted, with (at any rate in the great majority of species) cryptic under-sides.

As regards other families, I have come across but one reference to such a habit among the Pierines. Mr. W. H. Edwards, in his "Butterflies of North America," 1897, quotes Mr. William Couper's observation as to a habit of *Colias philodice*, Godart, in Anticosti :—

"When it alights on a flower, instead of being erect on its feet it lies sideways, as if to receive the warmth of the sun."

The original passage occurs in the "Canadian Entomologist," vol. vi. p. 92, 1874; if therefore this be truly such a list as is under discussion, Mr. Couper deserves the credit of having first recorded it, but at present I am doubtful on the point.

Professor Poulton, in a discussion at the Entomological Society, stated that on one occasion many years ago, he had observed a pronounced movement in the nature of a list in the Green Hairstreak (*Thecla rubi*). The butterfly was observed at rest on the flat surface of a leaf at Birdlip, Gloucestershire, and it let itself down so completely that it seemed to lie flat on the leaf. The obliteration of shadow was very marked, and had at the time forced itself upon his mind as the significance of the attitude.[1]

Mr. Rowland-Brown said that he had also observed an extreme list in the same butterfly. He has since been good enough to call my attention to a note in No. 13 of the *Bulletin de la Société Entom. de de France*, 1909, pp. 211,212, on the egg-laying habits of *Pararge maera* and *P. megaera*, in which it is stated that the latter, creeping in to lay her eggs, lies almost flat on the ground—"elle plie ses ailes, rentre les ailes supérieures entre les ailes inférieures, puis les incline parallèlement au sol; elle entre alors sous les brins de l'herbe . . ." (J. de Joannis).

Dr. T. A. Chapman[2] has published some interesting notes on heliotropism, and more especially on list in *Callophrys* (*Thecla*) *rubi* and *Thestor ballus*.

Mr. L. B. Prout netted a specimen of the Green Hairstreak which settled on his finger in such a position as resulted in the vertical exposure of the under surface to the sun. When Mr. Prout moved his finger the butterfly changed its position in a corresponding

[1] *Proc. Ent. Soc. Lond.*, 1906, p. xxviii.

[2] *Entomological Record*, vol. xviii., 1906, p. 168.

manner; the experiment was repeated several times with the same specimen, always with the same result.[1]

As before stated Mr. G. A. K. Marshall insists on the relevant fact that orienting butterflies are very much on the alert, moreover in a letter to the author he says that he has observed that three S. African butterflies, *Precis cebrene* and *Hamanumida daedalus*, at Salisbury, and *Mycalesis campina*, Auriv., in Chirinda forest, when sunning themselves closed their wings with a snap when a heavy cloud passed over the sun.

It would be most interesting if it could be shown that orienting butterflies on the approach of an enemy close their wings in the same manner. To obtain such evidence might well be difficult, but good evidence on the point would be crucial.

§ 10. The Inverted Rest Attitude of Lycaenids and some other Butterflies.

It was at Benares, at the end of 1903, that my attention was first drawn to the fact that the curious lobes at the anal angle of the hind-wings of certain Lycaenids—species of the genera *Aphnaeus*, *Pratapa*, and *Rapala*—are everted so as to be nearly at right angles to the plane of the wing. The diagram on p. 69 *supra* (Fig. 5) shows that this eversion of the lobe helped in the suggestion of a head at the posterior end of the body. The original sketch for the diagram was made before I had heard of the "false head theory." The resemblance would of course be more striking if the Lycaenids in question, like so many of the family, habitually rest with the head downwards.

Prof. Poulton discussed the "false head" at some length in his notes to Mr. G. A. K. Marshall's paper on "The Bionomics of South African Insects."[2] He there showed by a reference to Kirby and Spence that the resemblance of the tails of some Lycaenids to antennae was observed early in the nineteenth century. I venture to give the passage in full:—

> Dr. Arnold has made a curious observation (confirmed by Dr. Forström with respect to others of the genus) on the use of the long processes or tails that distinguish the secondary wings of *Hesperia iarbas*. These processes, he remarks, resemble antennae, and when the butterfly is sitting it keeps them in constant motion; so that at first sight

[1] *Entomological Record*, vol. xviii., 1906, p. 214.

[2] *Trans. Ent. Soc. Lond.*, 1902, pp. 373–375.

> it appears to have a head at each extremity: which deception is much increased by a spot resembling an eye at the base of the processes. These insects, perhaps, thus perplex or alarm their assailants.[1]

Hesperia iarbas at first puzzled me, but it would appear to be the insect now known as *Deudorix* (*Rapala*) *iarbas*, Fabr., and the very close ally of *D. melampus*, Cram., one of the insects in which I first noticed the peculiar structure of the anal lobe, about eighty-six years after Dr. Arnold's observation.

I remember well seeing a Lycaenid at rest on a leaf at Solon, on the road to Simla, in October, 1903, and noticed its tails waving about, as I thought at the time blown by the wind.

On March 12th, 1904, the pretty white, black, and orange *Talicada nyseus*, Guér., was positively swarming near Kandy. I repeatedly watched it settle with its head upwards and immediately turn about so that its head looked downwards.[2]

At Mortehoe, June 5th, 1905, Mr. A. L. Onslow and I searched from sundown to dusk for *Emmelesia albulata*, Schiff., in a field adjoining my house; we failed in our search, but incidentally came across a number of *Lycaena icarus*, Rott., asleep on the stems of grasses, etc. Out of fifteen specimens, twelve had the head down, three had the head up.[3]

The lobed and tailed Lycaenids are not too easy to observe; they are active and commonly fly about the tops of shrubs or small trees; when at rest they are not conspicuous and when disturbed dart swiftly off.

Dr. Dixey noted:—

> August 20th. Durban (Botanical Garden). Saw an "amphisbaenoid" *Lycaena* settled twice; the first time horizontally, the second time head downwards. On both occasions the false head looked much more like a head than the real one did. There was a constant slight movement of the hind-wings; and a waving of the false antennae.

Unluckily this specimen eluded capture. Again Dr. Dixey noted:—

> August 16th. Durban (The Bluff). Saw a Lycaenid settled on the top of a leaf horizontally. The false head was

[1] "An Introduction to Entomology," vol. ii. p. 255. First Edition, 1817.

[2] See above, p. 114.

[3] When this butterfly first settles on flowers in full sunshine it expands its wings very fully, the primaries being drawn somewhat away from the secondaries.

much more conspicuous than the real head, which was almost concealed; the real antennae were quite concealed.

This proved to be *Virachola antalus*, Hopff.; I have a note referring to the same species:—

A Lycaenid boxed off a plant close to the ground; it was sitting with the head downwards, but the false head was missing, having been bitten off, probably by a lizard.

Dr. Dixey was more fortunate than I with *Axiocerces harpax*, Fabr., since he notes:—

September 9th. Bulawayo, Rhodesia (near the Waterworks). This species was abundant at the catkin-like flowers of a shrub said by Mr. Davey to be a species of *Combretum*. When settled, it closely resembled (at a little distance) the seed vessels, of which many remained on the plant, though the latter was just coming into flower. On a near view, the false head of the Lycaenid looks extremely life-like, and is moved about by the butterfly in a most deceptive manner. The species settles either horizontally or head downwards. Attention seems to be drawn to the false head by alternate partial folding and unfolding of the everted margin of the hind-wing, while the butterfly is settled.

Coming now to my own observations, the false head was noted during life in five specimens (all females) of *Argiolaus silas*, Westw., but in none of them was the attitude at rest determined, indeed the insects usually settled high up on the trees beyond my limit of clear vision.

September 10th. The Matopos, Rhodesia. A male of the beautiful *Stugeta bowkeri*, Trim., was twice seen to settle with its head downwards on the catkin-like racemes of the shrub *Sclerocarya caffra*. The false head was very obvious. It opened and shut its hind-wings while settled.

September 28th. East London (Buffalo River). A specimen of *Phasis chrysaor*, Trim., was seen settled head downwards.

August 14th. Durban (near Sydenham "Old Cemetery"). A female *Hypolycaena philippus*, Fabr., exhibited a false head, but was not seen at rest.

September 15th. Victoria Falls. A specimen of *Catochrysops malathana*, Boisd. (*asopus*, Hopff.), was seen in the Rain Forest settled with its head downwards.

September 26th. East London. Two specimens of *Tarucus telicanus*, Lang, were seen in the Queen's Park sitting horizontally.

They were moving their hind-wings alternately *in the plane of the wings,* exactly as I had seen a *Lampides* do in the Nilgiris.

North Devon, September 1st, 1907. Walking with Mr. H. Champion along the Woolacombe sandhills late in the afternoon we observed thirty-nine specimens of *Lycaena icarus*, asleep on Marram, Privet, etc. No less than thirty-eight of these were sleeping with the head down, while the exceptional one was horizontal. In many instances the fore-wings were drawn so far back that the costae of the hind-wings overlapped those of the fore-wings. The antennae were porrected and near together.[1]

Mortehoe, September 11th, 1907. A ♀ *L. icarus* at rest on a Ragwort flower moved its hind-wings alternately.

Carácas, Venezuela, March 3rd, 1907. The dingy little *Catochrysops hanno*, Stoll, was seen sitting head downwards, opening its hind-wings at intervals.

Walderston, Jamaica, February 16th, 1907. *Calycopis pan*, Drury. The lobe of the hind-wing is everted as in *Aphnaeus*, *Argiolaus*, etc.

St. Ann's, Trinidad, April 1st, 1907. A ♀ of *Thecla spurius*, Feld., seen sitting head down; the hind-wing is folded; the lobe is large.

The Zebra-like *Thecla linus*, Sulz., is a common species in Trinidad. The lobe of the hind-wing is everted, but not quite to a right angle; it is curious that the tails are *crossed,* so that the tail of the right wing imitates the antenna of the left side and *vice versâ.* [Mr. Knight has made this very clear in Fig. 12, p. 326, *supra.*] The tails were seen to move slightly, and the false head looked more like a head than the real one. Though I have no note to that effect, I feel sure that I saw this species sitting head downwards.

My later Ceylon experience (Jan. to March, 1908) enabled me to add nine more species in which I have observed the inverted

[1] In the fourth Report of the Rugby School Natural History Society, 1870, p. 17, is an interesting note by Mr. Arthur Sidgwick, which I give at some length as the Report is not easily accessible. "On August 13th, 1870, I noticed on the road from Bex to Gryon, in the Rhone Valley, a large number of the Chalk-hill blue (*Polyommatus corydon*), on the umbelliferous plants by the roadside. It was just sunset, and they were all at rest. Their colour and shape effectually protected them from notice. . . . I noticed that they all rested *head downwards*. It occurred to me that even this apparently trifling detail of instinct or habit might be protective. The eye in wandering over a plant is arrested more easily than one would suppose by any outline *out of accord* with the general lines on which the plant is constructed." The note is accompanied by sketches showing that the butterfly resting head downwards is less conspicuous than one in the opposite position.

attitude, making in all nineteen species of *Lycaenidae.* It seems probable that sufficient observations are alone required to prove the habit to be general in that family.[1]

Zizera otis, Fabr., f. *indica,* Murray. ♀. One observation.

Everes parrhasius, Fabr. ♀. Two observations.

Nacaduba atrata, Horsf. ♂. Three observations.

Jamides bochus, Cram. ♀. One observation.

Lampides elpis, Godart. ♂. Two observations: in one the butterfly settled head upwards, but turned round immediately.

Lampides celeno, Cram. 10 ♂, 1 ♀.

Polyommatus baeticus, Linn. Both sexes. Nine observations.

Surendra quercetorum, Moore. ♀. One observation.

Loxura arcuata, Moore. One observation.

The "sawing" movement of the hind-wings observed at Kallár in the Nilgiris during 1904 in *Lampides* sp., and during *Tarucus telicanus,* Lang, and at East London, S. Africa, during 1905, was again observed in several Blues in Ceylon during 1908, viz. :—

Talicada nyseus, Guér.	Six observations.
Everes argiades, Pall.	Two observations.
Lampides celeno, Cram.	Three observations.
Polyommatus baeticus, Linn.	Six observations.

Prof. Poulton explains this movement[2] as assisting in the deception of the false head, but the explanation scarcely satisfies me since butterflies at rest do not usually move their antennae. It is, however, possible that movement as movement may challenge attack; compare the case of the Maina mentioned above;[3] also Col. Mander's experience.[4]

[1] Compare *Trans. Ent. Soc. Lond.*, 1905, pp. 85, 86, 127. Mr. Marshall writes: "I am quite satisfied that this (head down) is the usual position in *Lycaenidae*, and could add numerous species to your list, such as: *Aphnaeus*, *Spindasis*, *Axiocerces*, *Iolaus*, *Stugeta*, *Hypolycaena*, *Mimacraea*, *Myrina*, etc.. etc., but the simplest way is to mention the species which do *not* do it. Of these I know three only in South Africa: viz. *Alaena nyasae*, *A. amazoula*, and *Pentila tropicalis*—all distasteful species. Similarly this is the normal position in South African *Nymphalinae*, viz. *Atella*, *Lachnoptera*, *Hypanartia*, *Precis*, *Catacroptera*, *Crenis*, *Charaxes*, *Euralia* and *Salamis*, which are all the genera I can think of at the moment in which I have actually observed it. On the other hand, all the *Danainae* and *Acraeinae* hang with wings down. It is possible this may prove to be a good criterion of palatability, for the head-down position gives the insect a much better opportunity of launching into a rapid flight, and thus evading attack, which is not of such great consequence to distasteful species."

[2] "Essays on Evolution," 1908, pp. 282, 325, and the references there given.

[3] Page 526.

[4] *Proc. Zool. Soc. Lond.*, 1911, p. 788.

As regards the lobes to the hind-wings of so many Lycaenids the following additional facts may be noted:—

Aphnaeus (Spindasis) vulcanus, Fabr. Ceylon, 1908. In this species, which has a habit of curvetting rapidly about before settling on the ground, the lobes, which are small, are everted. The hind-wings are folded in such a way as to make a very slight convexity between the two tails, the nervures corresponding to the latter lying in re-entrant angles.

Rapala lazulina, Moore. Ceylon, 1908. The lobes are everted.

Loxura arcuata, Moore. Ceylon, 1908. This species has a peculiar darting flight. The arrangement of the wings at rest is somewhat complicated: the lobes, which are small, are half, or perhaps three-quarters, everted, showing an eye-spot when the insect is looked down upon from above; the long tails appear to be somewhat twisted—one overlying the other, their black and white tips curved upwards. The portion of the hind-wing between the extremity of the abdomen and the lobe is bent inwards. As touching the very nearly allied Indian species, *L. atymnus*, Cram., I noted at Calcutta in 1903, "its wings are much plaited longitudinally, and when at rest its extremely long tails, crumpled look, and brown colour give it quite the appearance of a dead leaf."

Tarucus theophrastus, Fabr., Sûdân, 1909, was seen to "saw" with its hind-wings.

Catochrysops eleusis, Dem. Egypt, 1909. This was several times discovered settled head downwards, and also seen to settle with its head up and immediately turn round. On one occasion while I was looking at two of them settled head downwards on a flower-head of grass, a third settled just above them, head up, but at once turned round, so that there were three of the pretty little butterflies sitting one above the other within a couple of inches.

Cyaniris argiolus, Linn., Hassocks, Sussex, July 24, 1911, seen to settle three times head upwards and at once turn round.

Mr. Frank Littlewood, of Kendal, records "on the 14th (August, 1910) I took a grand series of *Chrysophanus phlaeas* on the border of the Moss. . . . During the day the heather-bloom seemed to be a great attraction, but towards evening, in an adjacent cornfield, numbers were observed resting, with wings opened towards the waning sun, on the ripe heads of the corn, and a pretty picture they presented, dotted about the field like so many brilliant flowers. With a solitary exception all were head downwards."—*Entomologist*, 1911, p. 72.

Neither the inverted attitude nor the everted lobe would appear

to be confined to the *Lycaenidae*, as the following examples prove.

The common Jamaican Satyrine, *Calisto zangis*, Fabr., has a peculiarity of construction which appears significant. The anal angle of the hind-wing is somewhat produced, moreover on either under surface, at the angle, there is a small ocellus. When at rest the wings are raised over the back in the usual manner; the abdomen is covered by the hind-wings, which are folded closely under it, but the anal prolongation of the wing is everted at right angles, as in the lobed Lycaenids, and as in them the ocellus may be seen from above. On every occasion on which I noted the butterfly at rest it was upon the ground, so that I do not know whether it ever adopts the inverted attitude and is protected by a false head. But whether that be so or not, the approach to Lycaenid structure in a Satyrine is interesting.

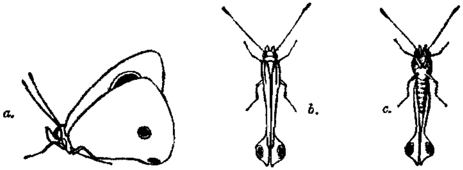


FIG. 19.—*Calisto zangis* at rest: (*a*) side view, (*b*) from above, (*c*) from below.

At first I thought that the eversion of the lobe in *C. zangis* might be due to the pressure of the curved surface of the pill-box in which the butterfly was confined, but subsequently I was abundantly convinced that such is not the case, for when the butterfly rests on a flat surface with which the wing does not come in contact it is everted just the same.

There is a well-developed lobe in the Oriental and Ethiopian Nymphaline genus *Cyrestis*, while the allied Neotropical genus *Megalura* has a somewhat similar structure (pointed out to me by Prof. Poulton), but I am not aware that the bionomic significance of these has as yet been worked out.

The fine large, blue-grey Nymphaline *Peridromia feronia*, Hübn., is a strong flyer, which has the unusual habit of settling upon tree-trunks, usually choosing palms with silvery-grey stems. The butterflies harmonize wonderfully with the silvery-grey stems as they sit with wings fully expanded like Geometers, but always *head*

downwards as noticed by Darwin in Brazil.[1] When disturbed they will return to the same tree again and again. I met with this species at Colon, La Guaira, and Trinidad, and noticed these points on each occasion.

Another large Nymphaline which appears invariably to sit head downwards is *Aganisthos orion*, Fabr., of which I saw several in Jamaica. The favourite resting-place seemed to be the trunk of a Logwood tree, *Haematoxylon campeachianum*, Linn., from one to four feet from the ground. This species rests with its wings closed above its back, and although the underside is cryptically coloured, the butterfly may be seen in profile from a considerable distance.

The pretty little Nymphaline, *Dynamine theseus*, Feld., with which I was familiar in Venezuela, Trinidad, and Tobago, often reminded me of a Lycaenid in its rapid flight and other ways; thus I saw it several times settle head downwards and then quickly move its wings, though I was not able to get near enough to make out the exact nature of the movement.

§ 11. General Remarks on the Rest Attitudes of Butterflies.

That the term "Rest Attitude" is used very loosely in this chapter I am well aware. A butterfly may be conceived as resting in several stages. First, it may settle to feed. *Sphinx* feeds on the wing; many a *Papilio* settles on a flower to feed, but flutters while sucking the honey, this, *e.g.*, is the habit of *P. erithonius*, Cram., *P. hector*, Linn., and *P. dissimilis*, Linn. Thus in Ceylon I found that the best way of distinguishing the last-named from the Danaids, which it mimics so closely, was by this fluttering. I am, however, not certain whether all the species have this habit. Many moths, notably *Plusia*, are intermediate between *Sphinx* and *Papilio* in this respect. The vast majority of butterflies feed with their wings still, either more or less widely spread out, or closed over the back. The *Hesperidae* rest in so many different ways as to be worthy of special consideration.

As all English collectors know, our two common Skippers, *Hesperia thaumas*, Hufn., and *H. sylvanus*, Esp., when settled on flowers elevate the fore-wings, which are somewhat drawn back, but hold the hind-wings almost horizontally. I have seen several exotic species adopt the same peculiar attitude, but the only two of which

[1] "Journal of Researches," etc., Ed. 1860, p. 33. Compare W. J. Burchell's observations (1825–1836), quoted by J. C. Moulton, *Ann. Mag. Nat. Hist.* (8), ii., pp. 184–7 (1908).

I can find notes to that effect are the common, insignificant little *Gegenes letterstedti*, Wallgr., of S. Africa, *Cymaenes silius*, Latr., which I came across in Tobago, and the Canadian *Atrytone hobomok*, Harr.

Many species, such as *Parnara mathias*, Fabr., *Notocrypta feisthamelii*, Boisd., and *Badamia exclamationis*, Fabr. (Ceylon); *Carystus coryna*, Hew. (Venezuela), and *Catia drurii*, Latr. (Jamaica), settle with all the wings in the vertical position, the fore-wings being often much drawn back between the hind-wings. The Sinhalese *Parnara colaca*, Moore, holds the hind-wings in an intermediate position.

In marked contrast to all those previously mentioned many Skippers settle with their wings spread out as flat as Boarmiid moths, such are: the S. African *Pterygospidea flesus*, Fabr., *Eretis djaelaelae*, Wallgr., and *Sarangesa motozoides*, Holland; the Indian *Sarangesa dasahara*, Moore, and *Celaenorrhinus ambareesa*, Moore; the Sinhalese *Tagiades obscurus*, Mab. (*distans*, Moore); *Caprona ransonetti*, Feld.; *Hantana infernus*, Feld.; and *Celaenorrhinus spilothyrus*, Feld.; the Jamaican *Hesperia syrichthus*, Linn., *Anastrus simplicior*, Möschl., and *Ephyriades otreus*, Cram., settle in a similar posture.

Many species settle with the wings nearly but not fully expanded, such are the S. African *Parnara fatuellus*, Hopff. and our own *Nisoniades tages*, Linn., and *Syrichthus malvae*, Linn.

Eudamus proteus, Linn. The rest attitude of this common species, as seen in Jamaica, is very striking. It was noted to rest with all the wings up, but partly open and with the fore-wings much sloped back. At the same time the conspicuous tails remain horizontal, nearly at right angles to the wings; for a great part of their length they overlap, but their extremities are divergent. If Mr. Knight's drawings do not represent this attitude quite as clearly as I should have liked, it is because I was not able to supply the artist with adequate material. The tails appear to be an impediment to the insect's flight, which is remarkably slow and quiet for one of the group. (See Fig. 10, p. 288.)

I have described above (pp. 191, 192, and Fig. 7) the curious folding of the hind-wings in the S. African *Rhopalocampta keithloa*, Wallgr. Something of the same kind may be seen in the S. African *Gegenes letterstedti*, Wallgr., and *Parnara fatuellus*, Hopff., as well as in the Sinhalese *Telicota bambusae*, Moore, *Parnara mathias*, Fabr., *Bibasis sena*, Moore, and *Badamia exclamationis*, Fabr.

All who have ever set *N. tages* must have observed that its ample wings are somewhat convex. The same characteristic is even

more marked in certain Neotropical Skippers, such as *Gorgythion begga*, Prittw., *Cycloglypha thrasybulus*, Fabr., and *Chiomara gesta*, H.-Schäff.—all met with in Venezuela,—and *Systasea erosa*, Hübn., in Tobago. In the last species the convexity is extreme.

Mr. Meyrick includes our *malvae* and *tages* in the same genus, *Hesperia;* but the difference in the form of the fore-wings is very obvious during life, as is the difference in the resting attitudes, and the distinctions seem to me to have generic value. Indeed it is because the grouping of the Hesperids into genera appears to be still in an inchoate state, that I think it better to deal with species rather than to attempt to generalize.

Apart from feeding on flowers, butterflies often rest from flight on the ground, on the upper side of leaves, or on tree trunks. Such a state of rest is more reposeful than that first described, but in many species it is varied by occasional closing and reopening of the wings; or in some Lycaenids by curious horizontal movements of the hind-wings only. A few Skippers, such as *Badamia exclamationis*, *Hantana infernus*, *Celaenorrhinus spilothyrus*, *Caprona ransonnetti* and *Pterygospidea flesus*, may occasionally he seen (even in bright sunshine) to settle on the *under side* of leaves. Most of these are conspicuous insects and some of them are less swift of flight than many of the family, and there is no doubt whatever that the concealment must afford them considerable protection.

The actual habits of butterflies when asleep are but little known, the great majority almost certainly close their wings over their backs, the fore-wings being more or less withdrawn between the hind-wings, but some of the larger Skippers, such as *Caprona*, etc., probably sleep with them spread out, like Geometers. Certainly our common Skippers, *Hesperia sylvanus*, Esp., and *H. thaumas*, Hufn., adopt the usual butterfly attitude, but many years ago Mr. Roland Trimen called attention to the fact that *Nisoniades tages*, Linn., sleeps with the wings inclined so as to form a roof, like many Noctuids.[1] The folding of the posterior third of the hind-wing alluded to above is another point of resemblance of the *Hesperidae* to the *Noctuae*.

As regards the sleeping attitude of *Hesperia* I again quote Dr. Dixey:—

> Mortehoe, July 14th, 8.35 p.m. Saw *H. sylvanus* resting; wings turned up flat over back, not in characteristic "Skipper" attitude.

As has been already stated, many Lycaenids (possibly all) sleep

[1] Barrett, "Lepidoptera of the British Islands," vol. i. p. 309.

head downwards. In some Butterflies, notably *Euchloë* and *Synchloë*, when the creature is at rest the hind-wings (which almost conceal the fore-wings) do not approach the stem on which it sits, but the abdomen is elevated some 30° to 40° and quite concealed between the hind-wings. This attitude greatly increases the similarity of the insect to a leaf.[1]

The notes of a number of observations on common English Butterflies, kindly placed at my disposal by Dr. Dixey, may be quoted here—

1897, July 12. Mortehoe. *S. semele*; flight more rapid than that of *H. janira*; it is also more apt to settle. When settling, chooses if possible a bit of grey rock or bare pathway. Sits with antennae expanded and projecting forwards, body raised somewhat on legs. At first settling, eye-spot of fore-wing generally just appears; then by a definite sharp movement the wings are further closed, and the eye-spot is visible no longer. *H. janira* as a rule shows eye-spot while resting [*i.e.* during temporary rest in daytime].

July 13. Mortehoe. Watched *V. urticae* at rest, quite 5 minutes without stirring. It raised its wings but did not completely close upper-wing behind lower, so leaving a (roughly) equivalent triangle of upper-wing showing, including the whole of the dark costal mark.

July 14. Mortehoe. *H. hyperanthus* at rest shows eye-spot of fore-wing, like *H. janira* [*i.e.* at *temporary* rest].

At 8.25 p.m. saw *H. janira* settle down to rest. Eye-spot of fore-wing quite concealed.

July 15. Mortehoe. Saw *H. janira* settled (in sunshine) with eye-spot of fore-wing quite covered.

Saw *G. napi* settled with about half of discoidal cell of fore-wing showing. Afterwards saw one with only tip of fore-wing showing.

August 11. Mortehoe. *P. megaera* at rest does not shut up like *S. semele* (at least not during temporary rest in hours of flight). It usually sits with wings almost completely expanded.

Aug. 13. Mortehoe. Saw *H. tithonus* at rest; wings entirely closed up. A cloudy evening.

1898, August 9. Mortehoe. Saw *H. tithonus*, ♀, settled on a bramble-leaf in sunshine, eye-spot showing. Cloud came over the sun, and *tithonus* shut up, eye-spot becoming invisible.

[1] See above, p. 162, and Plate V., Fig. 10.

Opened again when cloud passed. [Compare the observation on *Teracolus ione*, p. 549, *supra*.]

Recently M. J. Th. Oudemans has published an interesting memoir entitled "Étude sur la Position de Repos chez les Lepidoptères."[1]

M. Oudemans treats of only one aspect of the subject, but this he deals with exhaustively by numerous observations on living specimens of all the chief groups of Macrolepidoptera. His conclusions may be shortly expressed, almost in his own words, thus:—Lepidoptera have a sleeping-dress; this dress forms a harmonious whole. The different parts which contribute to form the whole dress harmonize in their colours and usually in their patterns.[2] The parts of the insect which are concealed during rest are quite frequently strongly contrasted in colour or pattern to the exposed parts. M. Oudemans explains the facts by the influence of exposure to light.[3]

M. Oudemans does not allude to the points chiefly dealt with in this section, but one of his beautiful photographs shows *Chrysophanus phlaeas*, Linn., sitting with abdomen tilted up at an angle of about 45° to the thorax, as I have shown in the figure of *Euchloë belemia*, Esp., on Plate V. He does not, however, call attention to its peculiar attitude. That it must greatly increase the resemblance to a dead leaf is obvious enough.

§ 12. Cosmopolitan Lepidoptera.

Next to novelties and rarities the insects that interest me most are the commonest species, and more especially those to which the adjective "cosmopolitan" may fairly be applied. We know next to nothing of the conditions which determine whether a species shall be scarce or abundant, local or widely spread.

It may be of interest to append a list of such species as I have in my wanderings found in districts far apart.

Polyommatus baeticus, Linn.

Simla, 1903; Pesháwar, 1903; Kháibar Pass, 1903; Malakand,

[1] *Verhandelingen der Koninklijke Akademe van Wetenschappen*, vol. x., No. 1. Amsterdam, 1904. (Read at Berlin, International Congress of Zoology, August, 1901.)

[2] Compare my remarks on the green Noctuid from New Zealand, *Erana graminosa*, Walk., p. 468, *supra*.

[3] Compare Dr. M. Standfuss, *Die Beziehungen zwischen Färbung und Lebensgewohnheit bei den Palaearctischen Grossschmetterlingen*. Vierteljahrsschrift der naturforsch. Gesellschaft in Zürich. xxxix Jahrgang, 1894. (Read November 6th, 1893.)

1903; Naini Tal, 1903; Benares, 1903; Jhánsi, 1904; Mt. Abu, 1904; Bijápúr, 1904; Anantápúr, 1904; Nilgiris, 1904; Ceylon, 1904 and 1908; Durban, 1905; Bechuanaland, 1905; Matherán, 1908; Egypt, 1909; Sûdân, 1909; Sydney, N.S.W., 1910; Fremantle, 1910.

Pyrameis cardui, Linn.

England: Wandsworth, Bonchurch, Mortehoe; Simla, 1903; Kháibar Pass, 1903; Kamáon, 1903; Darjiling, 1903; Nilgiris, 1904; Japan, 1904; Biskra, 1905; Kabylia, 1905; Algiers, 1905; East London, 1905; Durban, 1905; Colenso, 1905; Ladysmith, 1905; Johannesburg, 1905; Kimberley, 1905; Stormberg, 1905; Port Elizabeth, 1905; Cape Town, 1905; Ceylon, 1908; Egypt, 1909; Sûdân, 1909; Tasmania, 1910; New Zealand, 1910.

Utetheisa pulchella, Linn.

Teneriffe, 1887; Kháibar Pass, 1903; Kamáon, 1903; Lucknow, 1903; Anantápúr, 1904; Hong-kong, 1904; Ladysmith, 1905; Cape Colony, 1905; Sûdân, 1909.

Agrotis ypsilon, Rott.

England: Mortehoe; Jamaica, 1907; Egypt, 1909; Sûdân, 1909; New Zealand, 1910.

Cirphis unipuncta, Haw.

Mortehoe, 1897; Yang-tse-kiang, 1904; New Zealand, 1910.

Prodenia litura, Fabr. (*littoralis*, Boisd.).

Allahabad, 1904; Sukna (Darjiling), 1904; Egypt, 1909; Sûdân, 1909.

Scopula ferrugalis, Hübn.

England: Devonshire; Algeria, 1905; Madeira, 1905; Durban, 1905; Port Elizabeth, 1905.

Zinckenia fascialis, Cram. (*recurvalis*, Fabr.).

Kálka, 1903; Lahore, 1903; Benares, 1903; Ceylon, 1908; New Zealand, 1910; Sydney, 1910. [It is said to occur also in the Ethiopian and Neotropical Regions.]

Nomophila noctuella, Schiff.

England; Bermudas, 1901; Nilgiris, 1903; Biskra, 1905; Port Elizabeth, 1905; Johannesburg, 1905; Colesberg, 1905; Jamaica, 1907; Egypt, 1909; Sûdân, 1909; . . .

Eromene ocellea, Haw.

Mt. Abu, 1904; Queenstown, Cape Colony, 1905; Egypt, 1909; Sûdân, 1909.

Etiella zinckenella, Treit.

Bijápúr, 1904; Johannesburg, 1905; Victoria Falls, 1905; Ceylon, 1908.

Plutella maculipennis, Curt. (*cruciferarum*, Zell.).

England; Rannoch, 1868; Biskra, 1905; Hammam Meskutine, 1905; Norval's Point, Cape Colony, 1905; Gwaai, Mashonaland, 1905; Egypt, 1909; New Zealand, 1910.

§ 13. Seasonal Dimorphism.

Seasonal Dimorphism has long been a subject of study in the Oriental and Ethiopian regions, but in the Neotropical world comparatively little attention has been paid to it.[1] A visit of less than four months, and those within the limits of the winter, or dry season, affords but little opportunity for the investigation of such a difficult question—and the difficulty is increased by the paucity of cabinet specimens bearing adequate data—nevertheless I venture to offer the results of my observations for what they may be worth.

In the Old World we see in certain genera of the Satyrines that the same species exhibits two forms, characterized by the presence or absence of ocelli on the under surface of the hind-wings. Similarly two forms are met with in the Nymphaline genus *Precis*;[2] in the one ocelli on the under side of the hind-wings are well developed, but in the other they are rudimentary or entirely absent. With the absence of ocelli is often associated a more angulated form of the wings, which are sometimes tailed, while the whole under surface is often of a redder colour, and the insect when at rest is cryptic, sometimes resembling a dead leaf. Again, in many Pierines there are also two forms, the one characterized by the black markings on the upper surface being more pronounced, and sometimes by a suffusion or irroration of black scales; whereas in the other form there is an irroration of reddish scales on the under surface, with or without reddish or purplish markings.[3] Now these two forms have long been recognized as occurring for the most part in the wet and dry seasons respectively, though it must be admitted that in *Terias* and *Catopsilia*,

[1] See Dixey, *Proc. Ent. Soc. Lond.*, 1898, p. xxxix.

[2] Including *Junonia*.

[3] In *Catopsilia*, *Callidryas*, and *Ixias* the disco-cellular spots on the under side of both fore- and hind-wings are usually larger, with larger white centres and altogether more conspicuous in the dry season. Moreover, in *Ixias* dry-season specimens have on the under side of the hind-wing a series of reddish, or purplish, post-discal spots, which when fully developed have white centres (especially in *I. pyrene*), and call to mind the similarly placed ocelli so well known in the *wet*-season forms of *Mycalesis* and *Precis*, and indeed they are not unlike the rudimentary ocelli seen in intermediate specimens of those genera, though they never attain to the complicated "peacock-feather" pattern so characteristic of many *Nymphalidae*.

the correspondence is not nearly so close as in *Mycalesis*, *Precis* and *Teracolus*. However, for convenience these are usually spoken of as wet-season forms and dry-season forms, or even for shortness as "wet" and "dry."

When at rest, with wings closed above its back, the dry-season insect is usually more cryptic than the wet, resembling in some instances red soil, in others a dead or discoloured leaf. It is notable that the dry-season form is commonly more marked and more persistent in the female sex.

If among Neotropical butterflies similar pairs of forms are met with, I propose provisionally to speak of them as "wet" and "dry," and then to inquire to what extent they are found in the corresponding seasons of the year.

Calisto zangis, Fabr. (Jamaica). Although there is some variation in the size of the ocelli on the under side of the wings in my specimens, I am unable to divide them into seasonal forms.

Euptychia hermes, Fabr. (*camerta*, Cram). In the wet-season form the ground colour of the under side is of a bluish-grey, the transverse lines are distinct and the ocelli well marked.

In the dry-season form the ground colour is browner in tint, the transverse lines are faint and the ocelli are minute.

I give, in a tabular form, a statement of all the specimens that I took, divided into the three classes: "dry," "wet," and "intermediate." The specimens classed as intermediate I have attempted to divide according as they seem to approach nearer to one form or the other. Males and females are distinguished and the dates of capture given.

Euptychia hermes, Fabr.

Place.	Dry.	Intermediate.	Wet.	Date of capture.
Trinidad . . .	...	...	♂	19 Dec., 1906.
Panama . . .	...	...	♂	28 Dec., 1906.
Venezuela . .	♂ ♂ ♂ ♀ ♂	♂ ♀ ♂ ♂ ♂ ♀	♀	22–29 March, 1907.
Trinidad . . .	...	...	♂ ♀	1 April, 1907.
Tobago . . .	...	...	♂ ♀ ♀ ♀ ♂	6, 7 April, 1907.
Trinidad . . .	...	... ♂	♂	12 April, 1907.
Totals .	4♂, 1♀	1♂, 1♀; 4♂, 1♀	6♂, 5♀	

It is somewhat remarkable that the specimens from Tobago were all distinctly "wet" though the country showed every sign of extreme

drought. Here the distinction between the forms might be local and not seasonal; or, as I am disposed to think, a seasonal form may have become localized.

Precis lavinia, Cram. The nomenclature of this species is in great confusion. Messrs. Godman and Salvin brought together the various forms found in Central America under the name *coenia*, Hübn., including what is generally known in the West Indies as *genoveva*, Cram. Mr. G. A. K. Marshall has recently arranged the genus *Precis* in the National Collection, and I am happy to find myself in complete agreement with one whose knowledge of the genus is so intimate. Cramer figured three forms, all from Surinam; a ♂ which he called *lavinia*, a ♀ which he called *evarete*, and a ♀ which he called *genoveva*. The last two I agree with Mr. Marshall in considering to be dry- and wet-season forms respectively. The insect is extremely variable in ground colour, in the size of the ocelli on the upper surface (especially the anterior ocellus on the hind-wing), in the presence or absence of a greenish gloss, or "glance," and in the presence or absence of a transverse white band on the fore-wings (*zonalis*, Felder). In some specimens from Guiana this white band is replaced by a purplish gloss. It is almost impossible to divide these varieties into local races since the various forms overlap considerably, and the most widely different forms are found in Mexico. However, speaking generally, it may be said that the form *coenia*, Hübn., prevails in the United States and northern Mexico; that the form *zonalis*, Feld. (*genoveva*, *auct.*) prevails in the West Indies (approaching to *coenia* in the Bahamas); that the type form *lavinia*, Cram., of which the ♂ has a hind-wing with a green gloss, prevails in Brazil; lastly a brown form is found in Peru.

But what does not seem to have been generally noticed is that all the numerous varieties are themselves dimorphic. That is to say, that (as in the Indian species of *Precis*) they may be divided, as regards the colouring of the under surface of the hind-wings, into (1) those with several ocelli, of which two at least are conspicuous, (2) those in which the ocelli are merely indicated by black dots, or are entirely wanting, and (3) individuals intermediate in this respect. Analogy with the East would lead one to call the first *wet-season* forms and the second *dry-season* forms.

Precis lavinia, Cram.

Place.	Dry.	Inter-mediate.	Wet.	Date of capture.
Barbados	♀	...	♂	19 Dec., 1906.
Mt. Hope, Panama . . .	...	...	♂	28 Dec., 1906.
Constant Spring, Jamaica	...	♂	♂ ♀ ♀	31 Dec., 1906—8 Jan., 1907.
Mandeville, Jamaica . .	♂	...	...	20 Jan., 1907.
Port Antonio	...	♂	♂	25 Feb., 1907.
Constant Spring, Jamaica	♂	...	...	7 March, 1907.
Panama City	♀ ♀	...	♀	12 March, 1907.
Carácas, Venezuela . . .	♂ ♂ ♂	...	♀	19–28 March, 1907.
St. Ann's, Trinidad . . .	...	♂	...	1 April, 1907.
Tobago	♂	♂	...	6–8 April, 1907.
Total . . .	7 ♂, 2 ♀	4 ♂	4 ♂, 4 ♀	

I brought home twenty-one specimens; of these six were taken between December 18th and January 8th, five of them were "wet," only one "dry."

Fifteen were taken between January 20th and April 9th; of these eight were "dry," three "wet," and four "intermediate."

As the dry season advanced the "dry" form more or less displaced the "wet" form.

Dated specimens in Mr. W. J. Kaye's collection taken in the wet season are mostly "wet," as above defined; the same applies to specimens in the Hope Collection. Judging from the condition of many of the specimens I met with, it is a long-lived insect and therefore considerable overlapping may be anticipated.

Anartia jatrophae, Linn. Two forms are fairly well marked:—

Wet-season form. Under side. Ground colour nearly white; markings often conspicuously edged with scarlet. Ocelli black with blue centres. No transverse bar on hind-wing.

Dry-season form. Under side. Ground colour shaded with grey; markings edged with ochreous or reddish-brown, ocelli often blue only, orange-ringed. Hind-wing with a transverse grey bar.

Anartia jatrophae, Linn.

Place.	Dry.	Intermediate.		Wet.	Date of capture.
Trinidad	...	...		♂	19 Dec.
Panama	...	♀	♀	♂ ♂ ♂	28 Dec.
Constant Spring	♀ ♀ ♀		♂ ♂	...	31 Dec.—5 Jan.
Mandeville	♂	♂	♂	...	20, 21 Jan.
Mackfield	♂	♂		...	24 Jan.
Christiana	♂	...		...	16 Feb.
Port Antonio	♀ ♀	♀ ♂		...	24 Feb.—4 Mar.
Panama	...	...		♂	12 March.
Trinidad	...	...		♂	1 April.
Tobago	...	...		♂ ♂ ♂	4–5 April.
Total	3♂, 5♀	3♂, 2♀;	3♂, 1♀	9♂	

The table would appear to point to the forms being local rather than seasonal. The "dry" specimens, it will be observed, were all taken in Jamaica and were all of the race, or sub-species *jamaicensis*, Möschl,[1] but, on the other hand, not all the *jamaicensis* were "dry."

Callidryas eubule, Linn. The two forms are abundantly distinct, more especially in the male sex.

Dry-season form. ♂ Under side. Hind-wing, and all exposed part of fore-wing, irrorated with red-brown; the markings strong; stigmata clearly outlined.

♀ Under side. As in male but reddish irroration darker.

Wet-season form. ♂ Under side. No irroration: brown marking very faint; stigmata faintly outlined.

♀ Under side. Reddish irroration very faint.

Intermediate specimens are frequent, approaching now one, now the other form.

It may be at once admitted that these two forms of *C. eubule* are not restricted to the respective seasons to anything like the extent that is observed in the case, *e.g.*, of the S. African *Precis octavia*, Cram., and its "dry" form *P. sesamus*, Trim. Thus on January 12th, 1907, *C. eubule* was seen in numbers flying about a weedy field at Temple Hall, on the road between Constant Spring and Castleton, Jamaica. Three examples were secured; a female of well-marked "dry" and one of equally well-marked "wet" type, whereas the third, a male, may be described as "intermediate, inclining to wet." I was informed that there had been no rain for three weeks.

[1] See above, p. 260.

Callidryas eubule, Linn.

Place.	Dry.	Intermediate.	Wet.	Date of capture.
Barbados	...	♀ ♀	♂ ♂	18 Dec., 1906.
Trinidad	...	...	♂	19 Dec., 1906.
Savanilla, Colombia . .	...	...	♂ ♂	22 Dec., 1906.
Cartagena	...	♀	♂	23 Dec., 1906.
Colon, Panama	...	...	♂	28 Dec., 1906.
Constant Spring, Jamaica	♀	♂ ♂ ♂	♂ ♀	1-9 Jan., 1907.
Castleton, Jamaica . . .	♀	♂ ♂	♀	11-12 Jan., 1907.
Mackfield " . . .	♂ ♂ ♂ ♂	♀ ♀	...	25-27 Jan., 1907.
Montego Bay " . . .	♂ ♀ ♀	♀ ♂	...	4-5 Feb., 1907.
Walderston " . . .	♀ ♀	♀	♂	7-18 Feb., 1907.
Spanish Town, Jamaica .	♀	...	♂	21-22 Feb., 1907.
Port Antonio " .	♂ ♂	♂	...	3-5 Mar., 1907.
Constant Spring, Jamaica	...	♀	...	7 Mar., 1907.
El Valle, Venezuela . .	...	♂ ♂ ♀	...	26-27 Mar., 1907.
Zigzag " . .	...	♂	...	29 Mar., 1907.
Tobago	...	♂ ♂ ♀ ♀ ♂ ♂ ♀	♂ ♂ ♀	8-10 Apr., 1907.
Totals . . .	7 ♂, 7 ♀	14 ♂, 12 ♀	12 ♂, 8 ♀	

It will be observed that (as with *A. jatrophae*) no distinctly "dry" specimens were taken out of Jamaica. There is also evidence (very ambiguous in the case of Tobago) that the "dry" form tended to displace the "wet" as the season advanced.

Further, I had the advantage of examining Mr. W. J. Kaye's series of this insect. Of six specimens taken in Jamaica in the month of August (wet season) five are of the "wet" form, one of the "dry." Of two specimens taken in Trinidad in July, one is "wet," the other "intermediate," another taken in September is also "intermediate." A specimen taken in British Guiana in either November or December is "wet."

These facts are fairly in accord with the theory that the dimorphism is seasonal in *C. eubule*, especially if due allowance be made for the fact that the insect has the appearance of being long-lived.

Terias euterpe, Ménét. (Jamaica). My sixty specimens exhibit but very trifling differences that can be set down to possible seasonal dimorphism.

The specimens that I am disposed to regard as exhibiting dry-season coloration may be distinguished by the following characters on the *under surface*.

The reddish-orange edging of the wings is more conspicuous. The hind-wings are irrorated with purplish-brown scales, and the

purplish markings (especially the borders of the apical pink patch) are more conspicuous.

I do not give the results as set out in the following table with much confidence, and the division of the intermediate specimens into those inclining rather to "wet" or to "dry" respectively should not carry much weight. Subject to these limitations, it will be seen that the specimens considered as "wet" were commonest at the two extremities of the period, those considered as "dry" prevailed throughout the first half of February.

Terias euterpe, Ménét. (Jamaica).

Place.	Dry.	Intermediate.	Wet.	Date of capture.
Constant Spring . .	♂ ♂	♂ ♀ ♂	♂ ♂ ♂ ♀	31 Dec.—4 Jan.
" " . .	...	♂ ♀	♂	8–10 Jan.
Castleton	♀	♂ ♂	♀ ♂	11–12 Jan.
Mandeville	♂ ♀ ♀ ♂	♂ ♂ ♂	...	17–22 Jan.
Mackfield	♂ ♀	♂ ♀ ♀ ♂ ♂ ♂ ♂ ♂	♀ ♂	24–27 Jan.
"	♀	♂ ♀ ♀ ♀ ♂ ♂ ♂	...	29 Jan.—2 Feb.
Montego Bay . . .	...	♀	...	4 Feb.
Walderston	...	♂ ♀ ♂	...	8–14 Feb.
Christiana	♂	♂ ♂	...	16 Feb.
Walderston	♀	♀ ♂ ♀	♀	18 Feb.
Port Antonio . . .	...	♂ ♀ ♂	...	25 Feb.—1 Mar.
Constant Spring . .	...	...	♂	7 March.
Total . . .	6♂, 6♀	20♂, 10♀; 5♂, 2♀	7♂, 4♀	

Terias delia, Cram. (Jamaica, N. Coast of S. America). The extreme seasonal forms are quite distinct.

♂ Upper Side.

Wet-season form.—Ground pale yellow; costa broadly black; longitudinal black stripe broad.

Dry-season form.—Ground full yellow; costa faintly grey; longitudinal black stripe narrower.

♂ Under Side.

Wet-season form.—Uniformly white.

Dry-season form.—Hind-wings and costal three-fourths of fore-wings yellow irrorated with brown.

♀ Upper Side.

Wet-season form.—Ground white; costa broadly grey.

Dry-season form.—Ground of fore-wing pale yellow extending to costa.

♀ Under Side.

Wet-season form.—Fore-wing white; border pale yellow; hind-wing pale yellow irrorated with grey.

Dry-season form.—Fore-wing yellow, its tip and all hind-wing pinkish-orange irrorated with darker.

Terias delia, Cram.

Place.	Dry.	Intermediate.	Wet.	Date of capture
Savanilla, Colombia . .	...	♀	♂	22 Dec., f. *lydia*.
Colon, Panama	...	...	♂ ♂ ♂ ♂ ♀	28, 29 Dec., f. *lydia*.
Constant Spring, Jamaica	♂ ♂ ♀ ♀ ♂	♂ ♂ ♂ ♀ ♂	♂ ♂ ♂	1–8 Jan.
Castleton, Jamaica . . .	...	♀	♂	12 Jan.
Mandeville „ . . .	♀	♂	...	22 Jan.
Mackfield „ . . .	♀ ♀ ♀ ♂ ♀	♂	♂	24–26 Jan.
Montego Bay, Jamaica .	♀	...	♀	4 Feb.
Walderston, „ .	♀ ♂	...	...	12 Feb.
Port Antonio, „ .	...	♀	...	25 Feb.
Constant Spring, „ .	♀	...	...	7 March.
Ancon, Panama	♀ ♀ ♀	♂ ♂	...	11, 12 Mar.
Savanilla, Colombia . .	♀	...	...	15 March.
Carácas, Venezuela . . .	♀ ♀	...	...	18–25 Mar.
Total . . .	5♂, 16♀	8♂, 3♀; 1♀	10♂, 2♀	

An examination of this table shows clearly that the "dry" form became more prevalent as the season advanced, whereas the "wet" form disappeared. The first seven specimens, taken at Savanilla and Colon, December 22nd–29th, are of the form *lydia*, Feld. The last specimen taken, at Carácas, March 25th, is of the extreme "dry" form *persistens*, Butl.

A male taken above Constant Spring, *c.* 1000 ft., on January 1st, another male taken a little to the west of Constant Spring, *c.* 500 ft., on January 8th, and a male taken near the railway at Panama on March 12th, all approach the form *lydia*, Feld., in having the longitudinal black streak broader than usual. On the other hand, the width of the streak in the form *lydia* varies considerably.

An aberrant male of the "dry" form taken on the foot-hills above Constant Spring on January 1st, is entirely without the black streak, the orange scales alone marking its position.

Terias elathea, Cram. (Jamaica, Venezuela), appears to be specifically distinct from *delia*, but is certainly very closely allied to it; the females are difficult to distinguish, and some specimens of the male sex not easily separable. What I take to be the "wet" form has the under side irrorated with grey; the "dry" form with reddish.

Terias elathea, Cram.

Place.	Dry.	Intermediate.	Wet.	Date of capture.
Constant Spring, Jamaica . . .	♀ ?	...	♂	1, 2 Jan.
Montego Bay ,, . . .	...	♂	...	3 Feb.
Port Antonio ,, . . .	...	...	♂	3 March.
Carácas, Venezuela	...	♂ ♂	...	18–20 March.
Total	1 ♀	3 ♂	2 ♂	

In one of the Carácas specimens the black streak is very faint and might be described as obsolescent, in the other there is no trace of the black streak and scarcely any orange.

It will be observed that this aberration was in both species met with in "dry," or somewhat "dry" specimens, but I scarcely think that it can be considered as the extreme "dry" form, at all events without more material.

Pieris phileta, Fabr. (Jamaica, Venezuela, Tobago). In this species the seasonal differences are well known.

Wet-season form. Under side. Wings white, with but faint traces of yellow.

Dry-season form. Under side. Hind-wing and tip of fore-wing yellow; veins and lines in interspaces brown.

Pieris phileta, Fabr.

Place.	Dry.	Intermediate.	Wet.	Date of capture.
Montego Bay, Jamaica . . .	♂ ♀	♂	...	4–5 Feb.
Walderston ,, . . .	♂	♂	...	7 Feb.
Venezuela	...	...	♂ ♂	30 March.
Tobago	...	♂	♂	10 April.
Total	2 ♂, 1 ♀	3 ♂	3 ♂	

Here again the forms seem to depend on locality more than season.

In case any one should desire to examine more closely into the matter I append notes on the weather conditions during the period in which I was collecting.

Meteorological Notes. West Indies, etc.

Dec. 18.	*Barbados.* End of rainy season: a shower that morning early. Much rain in November. "Christmas Winds" prevailing.
Dec. 19.	*Trinidad.* "Much rain lately": very wet season: rain that morning; ground wet.
Dec. 20.	*La Guaira.* Muddy streets and the appearance of much recent rain.
Dec. 22.	*Savanilla.* Woods very dry: run-to-seed.
Dec. 23.	*Cartagena.* A dry, burnt-up look.
Dec. 27.	*Puerto Bello.* Rain all day: also rain the day before.
Dec. 28.	*Colon.* Heavy shower this morning. Very heavy rain reported November and early December.
Dec. 31.	*Constant Spring.* No rain for three weeks: unusually cold at Christmas. Country very dry and run-to-seed.
Jan. 7.	*Constant Spring.* A smart shower.
Jan. 15–16.	„ „ Trifling shower in the night.
Jan. 16.	*Mandeville.* No rain for eight weeks: vegetation very dry.
Jan. 19.	„ Several showers: clond most days.
Jan. 21–22.	„ Some rain in the night.
Jan. 24.	*Mackfield.* Reported to have been an exceptionally wet season: heavy rains November and up to December 12th; nothing but trifling rain since; vegetation and soil very dry.
Jan. 25.	*Mackfield.* Rain afternoon and evening.
Jan. 29.	„ Rain in early morning.
Jan. 31.	„ Two heavy showers this afternoon.
Feb. 2.	*Montego Bay.* Heavy showers about four or five days before our arrival: before then no rain for a fortnight.
Feb. 7.	*Walderston.* No rain since November 13th, except trifling showers February 3rd.
Feb. 11.	*Walderston.* Rain at dusk and early evening.
Feb. 12.	„ Rain afternoon and evening.
Feb. 13.	„ Wind and drizzle.
Feb. 15.	„ Slight rain in afternoon.
Feb. 16.	„ Heavy shower in afternoon.
Feb. 20–23.	*Spanish Town.* Rain while we were there and several showers the previous week.
Feb. 24.	*Port Antonio.* "No rain in January: some last week." Another informant, "Very dry up to the time of the earthquake (January 14th), frequent showers since."

Feb. 24–Mar. 5.	*Port Antonio.* Rained nearly every day or night of our stay. Heavy rain February 27th.
March 7.	*Constant Spring.* "A good rain eight days ago, and other showers since the earthquake (January 14th);" nevertheless everything looked very dry.
March 11.	*Panama.* Country very dry.
March 20.	*Carácas.* I was informed "last year was very wet, up to January 25th; since then it has been our dry season, though there was some rain last week."
March 21.	*Carácas.* Heavy shower late afternoon.
March 22.	,, Very heavy rain mid-day and afternoon.
March 23.	,, Heavy rain mid-day and afternoon—many hours.
March 29.	*La Guaira.* The road down showed traces of heavy rain within a few days.
April 4.	*Tobago.* Everything very dry, but was informed that there had been "some nice showers at night during March."
April 8.	*Tobago.* Very heavy showers.
April 12.	*Trinidad.* Heavy rain.
April 14.	,, A shower.

Seasonal Dimorphism in India and Ceylon.

With a view to seeing what light, if any, my fragmentary observations in India and Ceylon during the winter of 1903–4 might throw upon this puzzling subject, I have adopted the following method:—

In the Register, or Index, of my captures, I noted to every Pierine Dr. Dixey's estimate of its seasonal character, and then made my own (far less weighty) estimates of the seasonal characters of the genera *Precis*, *Melanitis*, *Mycalesis*, and *Yphthima*, and finally analyzed the results for localities, or groups of localities. Without prejudice, I took *Catopsilia gnoma* to represent the dry-season form of *C. pyranthe*, and in like manner *Catopsilia catilla* and *pomona* to be dry-season forms corresponding to a wet-season form *C. crocale*.

It must be borne in mind that such a classification is necessarily very vague, for while the extreme forms are easy to place it is most difficult to assess the numerous intermediate specimens.

	Wet season.	Somewhat wet.	Intermediate.	Somewhat dry.	Dry season.	
Precis orithyia . . .	2	2	...	...	4	Simla and Kálka, Oct. 10–20, 1903. Slight showers.
,, *oenone* . . .	...	...	...	...	6	
,, *lemonias* . . .	1	1	...	...	3	
,, *iphita* . . .	...	...	...	...	1	
Catopsilia pyranthe .	1	...	...	...	1	
Ixias marianne . . .	...	...	1	...	...	
Terias hecabe . . .	7	...	1	...	...	
,, *laeta*	...	2	2	1	...	
Huphina nerissa . .	3	3	...	...	...	
Total . . .	14	8	4	1	15	
Precis orithyia . . .	...	...	...	...	3	Peshâwar and Malakand, Oct. 22–29, 1903. No rain.
,, *oenone* . . .	...	...	...	...	2	
,, *almana* . . .	...	...	...	...	4	
Yphthima balanica .	1	...	...	...	...	
Terias hecabe . . .	1	3	2	2	1	
Teracolus etrida . .	...	...	...	1	...	
Total . . .	2	3	2	3	10	
Precis orithyia . . .	...	...	...	...	1	Lahore, Amritsar and Delhi, Oct. 31–Nov. 12, 1903. No rain.
,, *almana* . . .	...	...	...	1	2	
,, *lemonias* . .	...	...	...	...	4	
Catopsilia pyranthe .	7	...	...	...	...	
,, *pomona* .	...	1	...	...	...	
Ixias marianne . . .	...	...	1	1	3	
,, *pyrene*	1	2	1	...	...	
Terias hecabe . . .	5	...	...	...	...	
Teracolus etrida . .	...	...	2	2	2	
,, *protractus* .	2	...	...	...	...	
,, *puellaris* .	1	...	1	1	3	
,, *calais* . .	2	2	...	...	...	
Huphina nerissa . .	...	...	...	...	2	
Appias libythea . .	...	...	...	...	1	
Total . . .	18	5	5	5	18	
Precis orithyia . . .	...	...	...	2	2	Náini Tál, Lucknow and Benares, Nov. 16–Dec. 2, 1903. No rain.
,, *oenone* . . .	...	...	...	...	2	
,, *almana* . . .	...	1	...	1	...	
,, *lemonias* . .	...	1	...	...	2	
,, *iphita* . . .	...	...	...	...	3	
Yphthima philomela .	...	...	...	...	1	
Mycalesis perseus . .	...	1	...	...	1	
Catopsilia pyranthe .	1	...	1	...	2	
,, *pomona* . .	...	...	1	1	...	
Ixias marianne . . .	...	...	...	...	1	
,, *pyrene*	...	...	...	...	1	
Terias hecabe . . .	1	...	...	...	1	
Huphina nerissa . .	1	...	...	...	...	
Total . . .	3	3	2	4	16	

	Wet season.	Somewhat wet.	Intermediate.	Somewhat dry.	Dry season.	
Precis almana . . .	...	1	...	1	1	
" *lemonias* . .	...	...	...	...	1	
" *atlites* . . .	1	1	...	1	1	
Melanitis ismene . .	...	...	...	...	4	
Mycalesis indistans .	...	...	...	...	2	
Catopsilia pyranthe .	2	...	...	1	1	Calcutta. Dec. 4–12, 1903. No rain.
" *pomona* .	...	1	...	4	...	
Ixias pyrene	...	...	...	1	...	
Terias hecabe . . .	1	...	2	...	2	
Huphina nerissa . .	1	...	...	...	...	
Total . . .	5	3	2	8	12	
Precis lemonias . .	...	...	...	...	1	
Melanitis ismene . .	...	...	...	...	1	
Mycalesis indistans .	...	...	...	...	8	
Catopsilia pyranthe .	...	...	...	1	...	
Ixias pyrene	...	...	1	5	1	
Terias hecabe . . .	...	...	...	1	6	
" *laeta*	...	...	...	2	...	Darjiling. Dec. 13–22, 1903. No rain.
Huphina nerissa . .	1	...	...	...	4	
" *nadina* . .	...	1	...	...	2	
Tachyris hippo . . .	...	...	...	...	1	
Prioneris thestylis .	...	...	...	...	1	
Hiposcritia lalage . .	...	...	2	1	...	
Total . . .	1	1	3	10	25	
Precis orithyia . . .	...	...	...	...	3	
" *oenone* . . .	...	...	...	...	1	
" *almana* . . .	...	...	...	...	2	
" *lemonias* . .	...	...	...	...	1	
Ypthima inica . .	...	...	...	2	...	
Catopsilia pyranthe .	1	...	...	1	2	Bankápúr, Jhánsi, Agra, Jaipúr, Ajmir and Mt. Abú, Dec. 24, 1903–Feb. 3, 1904. Slight rain, Jan. 14–23.
Ixias marianne . .	...	...	...	2	5	
Terias hecabe . . .	2	1	...	1	2	
" *laeta*	...	...	3	6	10	
Teracolus etrida . .	...	1	5	2	3	
" *puellaris* .	...	...	...	...	1	
Huphina nerissa . .	...	...	...	...	7	
Total . . .	3	2	8	14	37	
Precis oenone . . .	...	...	...	1	...	
" *almana* . . .	...	...	...	...	2	
Melanitis ismene . .	...	...	1	...	...	
Byblia ilithyia . . .	...	...	...	4	...	
Catopsilia pyranthe .	1	...	...	...	3	
" *pomona* . .	...	...	...	1	...	
Ixias marianne . . .	...	...	...	2	...	Bijápúr, Anantápúr and Bangalúr. Feb. 16–23, 1904. No rain.
Terias hecabe . . .	...	...	...	1	...	
" *laeta*	...	...	1	...	...	
Teracolus etrida . .	...	...	2	2	5	
" *dulcis* . .	...	...	...	...	1	
" *amatus* . .	2	...	...	...	...	
" *eucharis* .	...	...	...	...	1	
Total . . .	3	...	4	11	12	

	Wet season.	Somewhat wet.	Intermediate.	Somewhat dry.	Dry season.	
Precis orithyia . . .	...	...	...	1	...	Nilgiris, Trichinápalí, Tanjúr, Mádura. Feb. 24–March 7, 1904. Very slight rain in Nilgiris.
,, *oenone* . . .	...	...	...	...	1	
,, *almana* . . .	...	...	...	1	...	
,, *lemonias* . .	...	...	...	1	1	
Melanitis ismene . .	...	...	...	...	3	
Mycalesis perseus . .	...	...	...	...	3	
Yphthima hübneri . .	...	...	...	...	1	
Byblia ilithyia . . .	1	1	...	...	...	
Catopsilia pyranthe .	...	...	2	2	...	
,, *pomona* . .	...	...	...	1	...	
Ixias marianne . . .	...	...	1	...	1	
,, *pyrene*	...	2	...	3	...	
Terias hecabe . . .	...	...	2	1	2	
Teracolus etrida . .	1	...	...	...	...	
,, *eucharis* .	...	...	...	...	1	
,, *danaë* . .	3	5	2	1	...	
Huphina nerissa . .	...	1	3	1	3	
Catophaga paulina .	...	1	...	1	4	
Total . . .	5	10	10	13	20	
Precis almana . . .	4	...	...	...	1	Ceylon. March 10–26, 1904. Several showers.
,, *atlites* . . .	1	2	...	2	2	
Mycalesis mandata .	1	...	...	...	...	
Catopsilia pyranthe .	2	...	...	...	...	
,, *pomona* .	...	...	2	2	1	
Ixias pyrene	...	...	...	1	...	
Terias hecabe . . .	4	2	1	...	1	
,, *laeta*	...	...	...	...	1	
Huphina nerissa . .	1	...	1	...	1	
Catophaga paulina .	...	...	2	...	2	
Total . . .	13	4	6	5	9	

There was a storm at Simla on October 10th, and a few trifling showers during our expedition to Bághi, but we saw no sign of rain after that, and indeed scarcely a cloud, save at Kurseong, until January 14th, when there was a thunderstorm at Jhánsi. There were then several very slight showers terminating with a long but not heavy rain on January 23rd. There was a very slight fall at Konúr on the night of February 29th—March 1st. Then no further rain till Kandy, March 10th. There were several showers in Ceylon.

At Simla the effects of the monsoon were not quite past, and wet-season forms were slightly more numerous than dry; the same applies to Ceylon. At all the other places, as might have been expected, dry-season forms predominated. Calcutta occupies an intermediate position.

It must, however, be admitted that to prove a species to be

dimorphic is not necessarily to prove that the forms are associated with seasons. In the genus *Precis*, so far as my very few observations (limited to the dry season) are worth anything, the two forms ocellated and non-ocellated seem to be closely associated with wetness and dryness respectively. *Catopsilia pyranthe*, as Dr. Dixey[1] has shown, occupies a far less clear position, and I may add that *Terias hecabe* did not appear to me to follow any rule. The two forms were taken together in most places.

Many dwarfed specimens of the genus *Precis* were met with as the season advanced; with the exception of one, *P. almana*, form *asterie*, they were all of the "dry" type, most of them markedly so. The smallest *Terias hecabe* was of the "dry" form, so was a dwarf *Teracolus dulcis*; two dwarfed *T. etrida* were "dry," two were "intermediate." A dwarf *Belenois mesentina* was "dry," but a dwarf *Catopsilia pyranthe* and a dwarf *Huphina nerissa* were "intermediate," while a dwarf *Teracolus calais* was actually of the wet-season form.[2]

Weather in Ceylon—1907–8.

I add, as an Appendix to Chapter VII., an abstract of my notes on the rain during my visit.

1907.

Nov. 1. [Heavy rain at Colombo. Reported to me.]

Dec. 25. [Shower about Christmas Day. Reported to me.]

1908.

Jan. 1. [Another shower about New Year's Day. Reported to me.]

„ 6. Thunder-shower: streets wet when we landed.

„ 7. Mt. Lavinia. Some rain.

„ 8. Kalutara—drops on leaves—few insects before 10.30 a.m.

„ 11. Mt. Lavinia. Heavy thunder-shower.

„ 15. Kandy. Rain most of day: heavy in afternoon and evening.

„ 16. Kandy. Slight rain, thunder.

„ 17. Kandy. Very slight rain.

„ 26. Kandy. Rain all evening: not heavy.

„ 27. Kandy. Dull day: everything wet; heavy rain, evening.

„ 28. Kandy. Slight rain, evening.

„ 29. Kandy. Slight rain in morning.

Feb. 19 and Feb. 20. [Heavy rain reported at Hatton.]

„ 21. Kandy. Very slight rain, afternoon and evening.

[1] See Dixey, *Trans. Ent. Soc. Lond.*, 1902, p. 189; and *Proc. Ent. Soc. Lond.*, 1904, pp. lii., liii. Also Col. N. Manders, *Trans. Ent. Soc. Lond.*, 1904, p. 701.

[2] See above, p. 68, footnote.

Feb. 22. Kandy. Some rain morning, rather heavy 11 p.m. [reported heavy, Anantapura].
„ 24. Dambulla. Showery.
„ 25. Anantapura. Heavy showers throughout morning.
Mar. 5. Hatton. Very slight rain, afternoon.
„ 6. Hatton. Rain midday for over an hour.
„ 7. Hatton. Heavy rain, 2–3 p.m. Thunder.
„ 14. Bandarawela to Nuwara Eliya. Heavy rain, noon to 5 p.m.
„ 15. Nuwara Eliya. Heavy rain, 2 p.m. Thunder, 4 p.m.
„ 16. Nuwara Eliya. Heavy rain, noon to 1 p.m.

§ 14. The Selection as Resting-places of Yellow Leaves by Yellow Butterflies.

Intimately bound up with the attitude at rest is the question whether or no insects select resting-places of a character likely to make the most, so to say, of their cryptic colouring.

As there still appear to be entomologists of wide experience who doubt whether butterflies, impelled by instinct, ever select resting-places of like colour with themselves, it seems worth while to bring together the following facts.

Mr. A. H. Hamm has made some striking observations tending to an affirmative answer to this question.[1] He stated that in 1904 he had some thirty plants of Cactus Dahlia growing in his garden: two were pure white, the rest of various colours. On three evenings he saw a male of *Ganoris rapae* at rest, each time on a white flower. In the discussion which followed, Dr. T. A. Chapman mentioned that he had once followed a specimen of *Colias edusa* for a considerable distance, and observed that it invariably came to rest upon a yellow leaf. Following up his observations in 1905, Mr. Hamm observed five more examples of *Ganoris rapae*. Two were well concealed among the flowers of the White Dead-nettle (*Lamium album*), three were resting on the silvery undersides of Bramble leaves. In the interesting discussion which followed, Mr. H. Rowland-Brown said that he had known *Ganoris napi* rest for the night on the white flower of a *Leucojum*. Col. J. W. Yerbury mentioned the case of *Euchloë euphenoides* and *Zegris eupheme* in Spain roosting on the flower heads of *Biscutella* [a Crucifer with yellow flowers]; Dr. T. A. Chapman said he had seen the same thing in the South of France. I have myself observed at Mortehoe (August 15th, 1910) a male

[1] *Proc. Ent. Soc. Lond.*, 1904, p. lxxv., and *Proc. Ent. Soc. Lond.*, 1905, p. lxxiii., and the interesting discussion following the latter paper.

Ganoris rapae asleep upon a yellow Dahlia; it was *fairly* concealed. I could not find any other specimens. Again, in the same place a week later, I found a male *G. napi* asleep on a greyish-white corymb of *Hydrangea;* it was extremely cryptic so far as colour was concerned.

Many years ago the late Mr. Geo. Norman and myself took a lot of *Polia chi*, Linn., at rest close to the hydropathic establishment at Forres, and we were much puzzled by the fact that, while many were taken on whitewashed walls, where they were difficult to detect, quite as many were found resting on dark tree-trunks and could be easily seen at many yards' distance. Can this indifference to background be accounted for by distastefulness? Or is the species only learning to take advantage of the artificial white background?

In the Bághi Forest, near Simla, I was struck by the way in which the conspicuous yellow *Terias hecabe*, Linn., disappeared when it settled on a low shrub with oval leaves fading to a yellow tint, the rounded form of the wings aiding its concealment.[1] But the most convincing case that up to that time had come under my own observation was a large yellow butterfly (I had no net, but think it was probably *Catopsilia catilla*, Cram.) which I saw in the garden of the University of Bombay. I saw this settle again and again, invariably on a small shrub with yellow leaves. The very conspicuous fly would vanish suddenly, and it was only after several attempts that I succeeded in catching sight of it when settled, so strong was the protective resemblance (February 10th, 1904).

It is a singular coincidence that on passing through the garden of the University of Bombay, March 22nd, 1908, I again saw a *Catopsilia* and watched it settle on a shrub; this was not a yellow-leaved plant, as on the former occasion, but its leaves varied a good deal in colour, and the butterfly *settled on the yellowest;* it was certainly much less conspicuous than it would have been on the greenest leaf. A German fellow-traveller whose attention I called to the butterfly agreed as to the partial concealment by the similarity in colour.[2]

In an analogoüs South African case I am able to supply fuller details:—

Eronia cleodora, Hübn., is a common Natal Pierine. Few insects are more conspicuous in the net than this beautiful fly with its combination of creamy-white, jet black, and deep yellow, and one might well wonder how it could possibly manage to hide itself. I watched it settle once upon the ground, and strangely enough it was not conspicuous when its wings were closed and the brilliant yellow

[1] See above, p. 46. [2] See above, p. 94.

of the underside was fully exposed to view. Then I twice saw it settle on grass; when the wings were half open it was very conspicuous, but when they were closed it was far otherwise. Four times I saw specimens go to rest on the leaves of a coarse plant, called by the natives *u-Bomaan*, which forms the bulk of the undergrowth of the scrub on The Bluff, at Durban. Each rested with its wings closed and hanging down more or less, in which position its general shape was not unlike that of a leaf, while its colour, yellow blotched with purplish-brown, had a striking resemblance to the many yellow, eaten and blotched leaves upon the shrubs. The brilliant insect lost itself in its surroundings, although this was not a case of definite leaf mimicry as in *Kallima* or even in *Precis*. A rough coloured sketch made at the time gave (apart from artistic shortcomings) a faithful representation of some of the leaves. From this sketch and specimens of the butterflies Mr. Horace Knight made a beautiful painting, reproduced on the frontispiece of this volume.

Dr. Dixey has a note which confirms the above:—

> The Bluff, Durban, August 16th. *Eronia cleodora*, ♂, observed to settle near leaves which, turned yellow and showing slits and circular holes, closely resembled its under surface.

Mr. J. Medley Wood, the Director of the Natal Botanic Gardens, kindly writing to give me the name of the plant, says that the food plants of *E. cleodora* are *Capparis zeyheri*, Turcz, and *Niebuhria pedunculosa*, Hochst., of the same Natural Order.[1]

Perhaps the most tropical-looking butterfly that we met with in South Africa was the large Nymphaline, *Salamis anacardii*, Linn.; nearly four inches across the wings, greenish-white, with a strong pearly lustre, it is a very beautiful creature. Its flight is very weak. Mr. A. D. Millar of Durban said that it was fond of resting in a particular tree or shrub with glaucous leaves.

Dr. Dixey has a note:—

> Sydenham, Durban, August 15th. Watched *Salamis anacardii*. It flew in a slow, flappy, undecided way from side to side of the road, settling each time for a second or two on a tree. Presently it reached a tree whose leaves were about the same size as the *anacardii* when resting with wings over its back. Here it settled, beneath a cluster of leaves, being fully exposed to view and yet well concealed. It remained quiescent until forcibly disturbed.

[1] See above, p. 184 and footnote.

I have no manuscript note, but remember well that before Mr. Millar mentioned the fact of *anacardii* having a proclivity for such trees, I saw one take refuge in a shrub, or small tree, having large glaucous leaves; and I am almost sure that I beat another specimen out of the same kind of tree, but I failed to see the insect at rest. With these may be compared Mrs. Barber's observation on the care exercised by *Papilio dardanus*, a ♂, in selecting a suitable resting-place.[1]

Writing of *Colias philodice*, Godart, Mr. W. H. Edwards says: "On marigolds and brilliant single zinnias they delight to pasture, for they have a keen sense of colour. I have known one of them alight on an amethyst in a lady's ring, after hovering about its owner so persistently as to attract attention, and it rested some seconds."[2]

Mr. S. H. Scudder quotes the following interesting observations on the same butterfly, which is called in America the "Sulphur."

"Dr. Minot once observed that when searching for its honied food the butterfly most frequently alighted on yellow flowers; and Dr. Packard has recorded that in a field where white asters and yellow golden rods were abundant the yellow sulphur butterfly visited the flowers of the golden rod much oftener than those of the aster, while the opposite was the case with *Pieris rapae*."[3] Again, in another place, he says, "and Jenner Weir has noticed how the white butterflies settled on the variegated leaves in his garden."[4]

The preference shown by the two butterflies for golden rod and asters respectively is interesting. These genera, highly characteristic of North America, are closely allied *Compositae*. On the other hand, *P. rapae was introduced into the country in 1860 or thereabouts.*

Some of Dr. Dixey's notes of his observations on common English butterflies have a bearing upon the point under discussion.

> July 12th. Mortehoe. Watched *G. brassicae*, ♂, resting on a *bramble* flower; wings closed so that the tip was the only part of fore-wing visible.
>
> August 12th. Mortehoe. Saw *G. rapae*, ♂, settled, towards dusk (nearly 8.0 p.m.), on a *bramble* leaf in a hedge. Wings vertical. On left side none of fore-wing showing but bare apex. On right side a large part of fore-wing showing. On

[1] Trimen, "South African Butterflies," vol. iii. p. 254. Quoted by Marshall, *Trans. Ent. Soc. Lond.*, 1908, p. 122. See also Dixey, *Proc. Ent. Soc. Lond.*, 1906, pp. xxviii., xxix.

[2] "Butterflies of North America," vol. ii., 1897, *sub philodice* (not paged).

[3] "Butterflies of New England," 1889, vol. ii. p. 1124.

[4] *Ibid.*, vol. ii. p. 1102.

careful examination this was found to be due to the fact that the right hind-wing was split, and the fore-wing had got caught in the cleft, thus preventing complete closure on that side.

August 23rd. Watched Whites in Sandy Lane. When settled for rest they look very much like turned-back leaves of *bramble*, near or on which they are fond of settling when meaning to remain settled for some time. In bright sunshine they often settle on flowers with wings partly or entirely spread, but in dull windy weather, like this morning's, they are apt not to fly unless disturbed, and then to settle again very soon. I disturbed one *G. rapae*, ♂, eight times and watched it settle again seven times. Five times it settled on *bramble*, although there was plenty of other vegetation. Of the other two settlings, the first was on the head of a yarrow, and the second on another low plant close to a spray of *bramble* with recurved leaves, which it closely resembled at a little distance.

August 27th. Saw *G. brassicae*, ♂, settle twice on *bramble* and close up its wings.

1898. September 7th. Have several times lately, when coming up Sandy Lane at dusk, seen *G. rapae*, settled, apparently for the night. Generally on *bramble*, wings quite closed. They will allow themselves to be seized with fingers or forceps, but then generally wake, and fly off if let go.

August 8th. Observed that *L. icarus* is fairly well protected (*i.e.* concealed) on heads of bramble-blossom when wings are closed.

1904. Highcliff, Hants, August 8th. Watched *G. brassicae*, ♂, settle down for the night about 7.15 p.m. After much fluttering about the stems of tall grasses, it came to rest on a head of hawkweed in the *pappus* condition, and remained there with wings hanging downwards and closed over its back.

I now give the notes of my experiences in the New World.

Barbados, December 18th, 1906. A ♀ of *Callidryas eubule*, Linn., was seen, when a cloud passed over the sun, to flutter about some herbage for a short time, as though looking for something, and finally to settle on a yellow leaf of the Life Plant, *Bryophyllum calycinum*, Salisb.

Constant Spring, Jamaica, January 8th, 1907. Two specimens of

C. eubule (sex not recorded) were seen, when the sky was dull, to settle on the lower, yellowish leaves of *Plumbago scandens*, Linn., close to the ground.

Mackfield, Jamaica, January 27th, 1907. I was watching the movements of a ♂ *C. eubule*, when a cloud passed over the sun; after fluttering about for a very short time it settled in the middle of a yellow, lower leaf of *Bryophyllum*.

Montego Bay, Jamaica, February 4th, 1907. A ♀ *C. eubule* was seen flying across the race-course. The track was carpeted with short grass of a rich full green, but amongst the grass were long trailing stems of the *Ipomoea pes-caprae*, Sw.; on one of these stems was a solitary bright-yellow leaf, far from any other of like colour: on this the yellow butterfly settled.

Montego Bay, Jamaica, same day. A ♀ *C. cubule* was seen to settle on an isolated yellow leaf of a creeper in a hedge, about six feet from the ground, all the surrounding foliage being green.

Constant Spring, Jamaica, January 4th, 1907. A dull afternoon: a ♀ *Terias euterpe*, Ménét., was seen to settle close to a leaf of its own size, shape and colour.

Same place and day. A ♂ *T. euterpe* was watched for some time and repeatedly disturbed; it seemed to avoid dark green foliage, and always settled on a low plant with yellow-green leaves.

Mackfield, Jamaica, January 27th, 1907; 4.30 p.m. A specimen of *T. euterpe* seen to settle four times as follows:—

(1) On a yellowish leaf of *Bryophyllum*: it was, however, but ill concealed thereby.

(2) On a pale green leaf.

(3) On a yellowish-green, finely-cut fern (*Adiantum* sp.).

(4) On a yellow-green leaf of a *Convolvulus* (or perhaps *Ipomoea*). In this case the concealment of the insect was remarkable.

Same place and day. Another specimen of *T. euterpe* was seen to settle on the underside of a yellowish leaf of the *Bryophyllum*.

Same place and day. A ♀ of *T. euterpe* was seen to settle three times:—

(1) On a yellow leaf of *Bryophyllum*; fairly cryptic.

(2) On a light green leaf of an unknown plant, somewhat cryptic.

(3) On a leaf of *Bryophyllum* less yellow than (1), the result less cryptic.

Mackfield, Jamaica, January 31st, 1907. Three specimens of *T. euterpe* (sex not determined and specimens not preserved) were watched with the following results respectively:—

(1) Seen to settle on a yellow leaf of *Bryophyllum*.

(2) Seen to settle three times: twice on yellow leaves of *Bryophyllum*.

(3) Seen to settle seven times. Twice on yellow leaves of *Bryophyllum* (in one case it was *very* well concealed); twice on a yellow fern (? *Polypodium* sp.); one other time it was well concealed, but the plant not noted; on two occasions it was less well concealed.

Constant Spring, Jamaica, January 1st, 1907. A ♀ of *Terias* (?) *elathea*, Cram. was seen to settle in the shade on a leaf of the same colour as the underside of its hind-wings.

Haragáma, Ceylon, February 13th, 1908. I watched a specimen of *Ixias pyrene*, Linn., f. *cingalensis*, Moore, a ♀, settle three times upon the yellowish leaves of *Bryophyllum*.

It should be noted that the faded leaves of the *Bryophyllum* have their margins tinted a purplish-red, resembling in colour the markings found on the underside of dry-season specimens of *Callidryas eubule* and *Ixias pyrene*.

Lion's Rump, Cape Town, January 1st, 1910. A male of *Synchloë hellica*, Linn., found asleep on a white flower-head of *Antennaria* sp. It was certainly cryptic. Time 7 a.m.

"With such facts before me I cannot but believe that the butterflies in question instinctively sought out leaves more or less closely resembling themselves in colour, with a view to concealment. Undoubtedly the most conspicuous butterflies on the wing are Whites and Yellows; on the move they are protected by their extremely rapid flight, but when at rest they stand in need of special protection. Many of these butterflies are restless and rarely settle, except to feed on flowers, to drink at damp places, or in the case of females to oviposit; to see them go to rest requires both time and patience; the best way being to watch them the moment that a cloud passes over the sun. I have very little doubt that our own Brimstone and Clouded-yellows if watched patiently will be found to seek out yellow resting-places."

With these words I concluded the section of my paper dealing with this subject.[1] Soon afterwards it came to my knowledge that Dr. Chapman had seen *Colias edusa* select yellow leaves to rest upon.[2] And the next year Mr. R. Trimen, F.R.S., wrote me as follows:—

"At Dornbirn, N. Tyrol, on July 18th, 1904. Opposite the hotel verandah where I was sitting there was, just across the road,

[1] *Trans. Ent. Soc. Lond.*, 1903, p. 643. Read October 7th.
[2] *Proc. Ent. Soc. Lond.*, 1904, p. lxxvi.

a long hedge of various shrubs. It was very hot, with brilliant sunshine (early afternoon). A ♂ *rhamni* came coursing along the hedge; I could see it approaching from some distance. It did not fly very rapidly, and I noticed that it once or twice interrupted its onward flight, by staying to flutter about part of the hedge, but it did not actually stop. It passed in front of me, and a little further on I saw it fluttering about some greenish yellow foliage in the hedge. It got among the leaves and did not reappear. . . . I slowly approached the spot . . . it was some little time before I could discover it, but I was at length rewarded by finding it at rest (fore-wings well down between hind-wings) on a leaf which in colour was very close to that of the underside of *rhamni's* wings. The leaf was large and pendant, and the outline of the resting butterfly scarcely showed against it."

Since then I have not added to my experience in this matter, but am thoroughly convinced of the reality of the habit.

In bringing this part of my subject to a close I venture to make a remark which has a wide bearing on the whole question of cryptic and mimetic resemblances.

Butterflies are most numerous and varied within the tropics. In the tropics the length of daylight varies much less than in temperate zones, and is many hours shorter than in the temperate summer. At the equator the sun is above the horizon for twelve hours every day; at the tropics the sun is above the horizon from a minimum of ten and a half hours to a maximum of thirteen and a half hours.

But although the sun is visible for these long periods, not so the butterflies. Very few comparatively are to be seen on the move before 9 a.m., and few after 3 p.m.

Now my point is that tropical birds, lizards, and other insectivorous animals have some six to eight hours of full daylight in which to hunt butterflies, when the latter are more or less at rest. This is a fact not usually allowed for in the discussion of questions of protective resemblances or mimicry, but it emphasizes the need for concealment.

To those whose tastes lie in that direction, few occupations are more delightful than that of the field-naturalist; yet if he, or she, is to advance our knowledge there are certain requisites:—patience, industry, and method. The successful butterfly hunter is by no means the idle and frivolous person that many take him to be: the

mere preservation of his specimens and records day by day is the work of many hours. Again, he is constantly brought into contact with problems that the most active brain may find it hard to grasp, let alone to solve.

The study of Nature in the field, no less than in the laboratory, is far from tending to simplify our explanations of the facts that meet our eyes. Each discovery does but open to our view new domains of the unknown. Theories that in our youth charmed us by their simplicity and completeness, prove in our old age to be hopelessly inadequate, so that if we are honest, we must admit the truth of the paradox, that every addition to our knowledge does but increase the vastness of our ignorance.

APPENDIX

INTRODUCTORY NOTE

THE numerous important writings of the great naturalist, Fritz Müller, who died May 21, 1897, are scattered through a variety of publications, some of which are difficult of access. Thus many of them are only to be found in the pages of the defunct German *Kosmos,* while many others written in Portuguese appeared in the publications of the National Museum of Rio de Janeiro. Ever since 1897 Dr. A. Möller, of Eberswalde, has been collecting the materials for an exhaustive work, in which all these scattered papers will be re-published, together with the letters and life of Charles Darwin's illustrious friend and warm supporter in the great controversies which followed the appearance of the *Origin of Species* in 1859. To the results of Dr. Möller's labours, now all but complete, all naturalists are looking with the keenest interest.

It is probable that, up to the present time, Fritz Müller's writings are best known, and have produced their greatest effect in English-speaking countries. This is to be accounted for by his speedy entrance into the Darwinian controversy—*Für Darwin* was published in 1864, and appeared in English in 1869; by his important contributions to the problem of Insect Mimicry, a subject rendered specially English by the writings of Bates, Wallace, Trimen, and Meldola; and by the fact that many of his observations *were recorded in English, and were published in this country,* together with others which were translated and given to English naturalists by Meldola, almost as soon as they appeared in their original form. Thus the brief paper by which Müllerian Mimicry became known to the world appeared in *Kosmos* (p. 100) in 1879, and in the same year in the *Proceedings of the Entomological Society* (p. xx).

It is, however, very different with the important and interesting subject dealt with in this Appendix. With the exception of one or two brief notes and a single paper of great importance (*Trans. Ent. Soc.*, 1878, p. 211), nothing written by Fritz Müller on the production and emission of scents by butterflies and moths has hitherto appeared in this country. When, therefore, my friend, Mr. E. A. Elliott, very kindly consented to translate Fritz Müller's papers for me, it appeared that by far the best use that could be made of those which dealt with this subject would be to publish them in close association with later work along the same lines. Such work has attracted the attention of my two friends, Dr. F. A. Dixey and Dr. G. B. Longstaff, the former for many years, the latter more recently. I was, therefore, extremely pleased when Dr. Longstaff agreed to publish these translations as an Appendix to a volume in which Dr. Dixey's and his own researches on the scents of butterflies are brought together. Dr. Longstaff, when he first read these papers, expressed the regret that he had not known of them during his South American journeys. That regret need now be felt no more by any English naturalist; for the difficulty of the language and the still greater difficulty of the medium of publication are alike removed in the following translations.

It is important to remember that many of Fritz Müller's observations here recorded still remain unique and unconfirmed. The power of distinguishing the scents emitted from particular organs on the wings, legs, or body of Lepidoptera, a power which Fritz Müller and his children (p. 611) exhibited in so remarkable a degree, has hitherto only rarely been possessed by other naturalists. Now, however, that these many records are published in a collected form, we may hope that still further attention will be directed to this aspect of the subject.

Among the observations in the following papers which become of special interest in the light of recent work, I may mention the peculiar development of air-vessels beneath the scent-brands (pp. 612, 637), a subject on which Dr. Dixey contributed a paper to Section D of the Portsmouth meeting of the British Association in the present year (1911). Furthermore, Fritz Müller's suggestions that there is connection between the anal brushes and the scent-pockets on the

hind-wings of male *Danainae* (p. 619) becomes of the greatest importance in relation to Mr. W. A. Lamborn's recent discovery that the scent-brands of the African Danaine genus *Amauris* are actually stroked with the brushes (*Proc. Ent. Soc.*, 1911, pp. xlvi–xlvii). Attention must be also directed to the interesting evidence of "convergent" evolution supplied by the scent-organs described in the sixth paper. The striking statement with which this memoir concludes will come as a surprise to many readers, especially when they remember the date of publication—1878. It should be noted, however, that the scales of Lepidoptera are so extremely variable in form and size—as may be seen even upon the surface of one and the same wing—that the independent production of almost any organ that could arise from modified scales would appear to be an usually easy task for convergent evolution. In contrast with the argument for convergence derived from the scent-organs is the masterly use, in the last four papers, of the same structures as evidence for systematic affinity.

In conclusion, I desire to thank Mr. E. A. Elliott for the great trouble he has taken to render these translations as accurate as possible, and Dr. Longstaff for accepting my suggestion that these valuable papers should appear in their present form.

E. B. POULTON.

OXFORD,
Dec. 31, 1911.

TRANSLATIONS

By Ernest A. Elliott, F.Z.S., F.E.S.,

OF PAPERS BY FRITZ MÜLLER, Ph.D.

§I. *On Hair-tufts, Felted Patches, and similar Structures on the Wings of Male Lepidoptera.*

The males of numerous species of diurnal Lepidoptera are characterized by the presence of specialized hair or scales on their wings. I will here bring together what I have been able to find on the subject of these structures in the few works on Lepidoptera to which I have access. The arrangement of genera adopted below is that of Kirby's *Catalogue of Diurnal Lepidoptera*, 1871.

Nymphalidae.

1. *Danainae.*

Danais.—The males have a patch of peculiarly constructed scales on the first branch of the median or on the submedian [nervure] of the hind-wing; sometimes it takes the form of a sac, which opens on the upper surface of the wing, and is filled (at least in dried specimens) with a brown dust.

Amauris (*Danais*, Sect. 1, Doubld., *Gen. D.L.*).—The males have a patch of peculiarly shaped, closely packed scales on the submedian of the hind-wing, not far from the anal angle.

Euploea.—In the male the inner margin of the fore-wing is usually rounded and projects, so as to cover a considerable portion of the hind-wing. The males of certain species possess, towards the inner margin of the fore-wings, one or more short streaks, formed of pale, peculiarly shaped scales, presenting a dull, somewhat chalky appearance. That part of the hind-wing which is covered by the projecting part of the fore-wing is often clothed with scales of a very remarkable shape. They are elongate, hair-like, basally rather broader, and end in an ovate enlargement, resembling

[1] *Jenaische Zeitschrift für Naturwissenschaft*, XI. (New Series, IV.), 1877, pp. 99–114.

The original footnotes are initialed "F.M.," those added in preparing this Appendix for publication, "E.A.E." or "E.B.P."

Square brackets, [ ], in the Appendix are used to indicate editorial matter.

the antennae of *Pieris*. In other species the scales on this spot are distinguished chiefly by their greater size.

The males of *Athesis*, *Thyridia*, *Olyras*, *Dircenna*, *Ceratinia*, *Sais*, *Mechanitis*, *Ithomia*, *Melinaea* and *Tithorea*, that is to say, of nearly all the genera which have been recently transferred from the *Heliconinae* to the *Danainae*, have "a tuft of hair on the upper side of the hind-wing in front of the subcostal" (Herrich-Schaeffer), or more correctly, as Doubleday describes it for *Olyras*, "an elongate spot, covered with very long delicate hairs." In the male of *Lycorea*, which also belongs to this group,[1] the hair-tuft is wanting, according to Herrich-Schaeffer, but they have (Doubleday) "a large tuft of hair on each side of the last abdominal segment, which can be for the greater part retracted into the abdomen."

2. *Satyrinae.*

In the male of *Antirrhaea* (*Anchiphlebia*, Butl.) *archaea* the inner margin of the fore-wing is arched as in *Euploea*, the costal margin of the hind-wing being also strongly arched, and on the under side of the fore-wing is a patch of hairs arranged like the teeth of a comb ("plaga pectinatim cirrata").

In *Gnophodes morpena*, as in species of *Euploea*, the hind wings of the males bear a large oval white patch near the costal margin.

The male of *Melanitis suradeva* (*cyllogenes*, Butl.) has a large, dark, silky patch on the fore-wing.

In *Satyrus roxelana*, *clymene*, *maera*, *megaera*, *hiera*, in *Epinephele lycaon*, *janira*, *ida*, *tithonus*, in *Hipparchia semele* and *arethusa*, the males have a patch of dark hair on the fore-wings.

Mycalesis.—"The most important character of this genus consists in the presence of a tuft of long hairs, either on the upper surface of the fore-wings, where there is a small slit, or pocket for their reception, or on the hind-wings, where they are covered by the inner margin of the fore-wings. This tuft of hair occurs, as usual, in the male only, and according to its position the genus can be divided into two groups" (Westwood).

The males of *Bia actorion* are distinguished by (1) a tuft of long pale leather-brown hairs near the inner margin of the hind-wings, which can be erected or depressed at will, and when at rest, are enclosed in a long pocket, and also by (2) a patch with long black silky hair near the anterior margin of the hind-wings. This latter patch is covered by a bare spot on the under side of the fore-wings, close to the inner margin.

3. *Elymniinae.*

Elymnias (*Melanitis*, Westw. *Gen. D.L.*).—The males have a tuft of hair on the upper side of the hind-wings, near the base.

[1] *Lycorea* is now included in the *Danainae* proper, all the other genera mentioned in the above paragraph being included in an allied sub-family, the *Ithomiinae* or *Neotropinae*.—E.B.P.

4. *Morphinae.*

Amathusia.—In the male there is on the upper side, near the inner margin of the hind-wing, parallel with the apex of the abdomen, a small, obliquely projecting tuft of hair: between this tuft and the first branch of the median is an elongate fold of the wing, in which a few long pale hairs are hidden.

Zeuxidia.—The inner margin of fore-wing in the female is almost straight, in the male greatly expanded and rounded. The hind-wings of the male have on the upper side, in the space between the costal and subcostal, an oval spot of pale leather-brown hairs; also in the middle of the cell a long ovate spot of brown, longitudinally directed hairs, and between this and the inner angle of the cell a series of hairs pointing obliquely towards the abdomen.

The male of *Discophora* has a silky spot in the middle of the upper side of the hind-wing.

Tenaris (*Drusilla*, Swains.).—Inner margin of fore-wing in the female is almost straight, in the male expanded at its base and emarginate at its centre. On the hind-wings, near the base, concealed under the expansion of the fore-wing, a tuft of hair; a second, longer tuft near the inner margin, lies opposite to the apex of the abdomen.

Clerome.—Inner margin of fore-wing in the male slightly produced. Hind-wing upper surface in the same, near extremity of the thorax, a tuft of fine hairs.

Thaumantis.—In the male a tuft of hair on the upper side of hind-wings, partly covered by the inner margin of fore-wings.

5. *Brassolinae.*

Opsiphanes.—The upper surface of the hind-wings of the males bears a brush of long hair, placed in the cell, near the origin of the first branch of the median; also a second tuft near the inner margin, close to the submedian, and about opposite to the middle of the abdomen. In *Opsiphanes soranus* an additional bunch of curved, leather-brown hairs between costal and subcostal. In *Ops. cassiae* I also observe, near the base of the wings, between costal and subcostal, a bunch of delicate hairs, but these are straight and of the same colour as the wings, and opposed to them, on the under side of the fore-wings, is a small dull grey spot between the median and submedian, close to the latter.

Caligo.—Hind-wing of the male with a small tuft of hair near the inner margin, opposite to the middle of the abdomen.

Narope.—"The submedian in the fore-wing of the male is curved in order to make room for a pencil of long orange-coloured hairs, springing from the under side between the median and submedian. Opposite to this is a smooth area on the upper side of the hind-wing."

Dasyophthalma.—Inner margin of fore-wing more arched in the male than in the female; on the upper side of the hind-wing in the former is an oval velvet spot, which is intersected by the subcostal and its branch;

a small oval spot near the base of the cell is devoid of scales, but furnished with an erect tuft of hair.

6. *Acraeinae* and 7. *Heliconinae*.

In the few genera of both these groups similar male characters appear to be absent.[1]

8. *Nymphalinae*.

The male of *Lachnoptera* has on the upper side of the hind-wings, near the costal margin, a characteristic spot of hair-like scales. These are long, almost linear, deeply emarginate and slightly expanded at their flattened bases, apically narrowed to a slender stalk and ending in a fan-like plate with a fringed margin.

In *Myscelia orsis* the "hind-wing is furnished with a brand extending from interspace five to seven" (Herrich-Schaeffer).

In the males of *Didonis biblis* I find on the under side of the fore-wing, near the inner margin between the submedian and median, at the spot where the latter emits its first branch, a jet-black patch of considerable size, which may be easily overlooked on the dark ground; a similar smaller spot lies close to it, nearer the base. Opposed to this lies a small spot on the upper side of the hind-wing.

Prepona.—In the male a tuft of hair springs from the edge of the hind-wing groove which encloses the abdomen, and opposite to it on the abdomen is an oval brand, surrounded by a bare border.

Agrias.—"Some, if not all the species have tufts of hair on the wings" (Butler).

LEMONIIDAE (ERYCINIDAE, Swains.).

No example of a male characterized by special hairs or scales is known to me in this family.

LYCAENIDAE.

Thecla.—In very numerous species the fore-wings of the male are marked with a roundish velvety or felted patch, near the apex of the cell, the patch not infrequently causes a more or less considerable displacement of the nervures, so that the difference between the neuration of male and female is sometimes as great as that between species of different genera. The size, shape and position of this "brand" vary considerably. Usually it is of a dark colour, and then, if placed on a similarly coloured surface, is often distinctly seen, as a dark spot on an otherwise colourless membrane, only after removal of the scales. More rarely it is pale (yellow or whitish) on a dark (black or blue) ground, as for example in *Thecla ambrax*, Westw.

[1] The males of an important section of the *Heliconinae* are characterized by the breadth of the glistening area covered with modified scales on the under surface of the fore-wing and of the hind-wing area by which it is covered.—E.B.P.

(*Gen. D.L.*, Plate LXXV., Fig. 7). In *Thecla bosora*, Hew., the upper side of the wing is dull blue, the fore-wing with broad brown anterior margin and borders, the brand very large and shining blue.

Papilionidae.

1. *Pierinae.*

In the males of *Leptalis* the inner margin of the fore-wings and the costal margin of the hind-wings are not uncommonly produced, as in *Euploea*. In such species there is on the hind-wing above, and on the fore-wing beneath, a large shining area covered with very small, closely placed scales, and in the middle thereof an oval, dull chalk-white or ash-grey patch. When the wings are expanded, the patches of both wings lie directly one on the other.

The male of most species of *Callidryas* has near the base and the costal margin of the hind-wing a chalky patch ("sac glanduleux," Boisduval), the size, shape, and colour of which vary greatly with the species. Sometimes it is covered by a mane of long hair springing from the cell. In other cases there is a patch opposite to it on the under side of the fore-wings, between the median and submedian. This opposed patch and the mane appear each to exclude the other; where I find the mane (*argante, trite*), the fore-wing patch is wanting; where the latter is present (*philea, statira*), the mane is absent.

Some species (as the Indian *pomona*) bear hairs also on the inner margin of the fore-wing. Finally, in some cases (*eubule*) both hairs and brands are wanting, though the patch on the hind-wings may not be absolutely untraceable.

In a few species of *Nathalis*, *Gonepteryx* and *Colias*, similar patches appear in the males.

2. *Papilioninae.*

The first of the divisions of the genus *Papilio* as recognized by Felder contains *P. priamus*, and the allied species of the now once again abandoned genus *Ornithoptera*. In the males of this division the inner margin of the hind-wings is much produced, and folded so that the upper surface lies within[1]; the outer side of the folded margin is more diffusely scaled, and furnished along the submedian with a mane of brownish erect bristles; the basal half of the fold is again rolled inwards; the inner surface of the entire margin of the upper side of the wing is covered with black scales, without hairs.

In the male of the second subdivision, which, like the first, is made up of species of the former genus *Ornithoptera*, the inner margin of the

[1] Dr. Karl Jordan informs me that the upper surface lies within only in papered specimens in which the margin has been pressed down. In nature the fold stands nearly upright, leaning towards the abdomen, and only its extreme base is again rolled inwards as described in the text.—E.B.P.

hind-wing is similarly folded, but the second fold of its basal half is turned outwards, and not inwards. The inner surface of the first fold, and that part of the wing hidden by it is brownish white, somewhat iridescent, and densely covered with a pelt of the same colour.

In the fifth division, which, together with their nearest allies, Felder calls American *Ornithoptera*,[1] the formation of the hind-wing in the male is similar to that of the second division; it is deeply emarginate at the anal angle, the greatly developed inner margin is inwardly folded, the basal part again outwardly, the hidden surface covered with brownish white scales, and, as far as the submedian, densely clothed with a wonderful silky white pelt.

Hesperidae.

In several genera the anterior margin of the fore-wings is folded ("costal fold," Herrich-Schaeffer), and the enclosed part thickly covered with pale down. In other species (*Ismene oedipodea*), the male has a large velvety patch near the base of the fore-wing; in others (*Hesperilla*), the males are characterized by a "scale blister" [Schuppenwulst] of the fore-wings, while in *Caecina* the inner margin of the fore-wing is produced near the base, is smooth beneath and covers a tuft of hair on the hind-wing.

So far for the diurnal Lepidoptera. That such structures are not wanting in the Heterocera is shown by *Calesia comosa*, Guen., whose male has a large hair-tuft on the upper side of the fore-wings.

However incomplete the above review may be, it will suffice to prove the wide distribution of analogous structures among diurnal Lepidoptera, as well as their astonishing variety. What an immense difference between the incredibly thick, snow-white, silky covering of hairs on the broad folded part of the hind-wing of *Papilio nephalion*, the large chalky patch on the hind-wing of *Callidryas trite*, covered by a long mane, and hidden under the inner margin of the fore-wing, the delicate hairy tuft in the centre of the hind-wing of *Opsiphanes cassiae*, and the coal-black spot in the middle of the *Morpho*-like blue of the fore-wing of *Thecla*! And yet among all these differences certain common features are to be found. Common to most of these structures is the fact that they are not usually exposed, but enclosed, it may be, and this is the most usual arrangement, between the inner margin of the fore, and the costal margin of the hind-wings, or between the inner margin of the hind-wings and the abdomen, in a folded part of the anterior margin of the fore, or the inner margin of the hind-wings, or finally in special furrows, slits or pockets. Not infrequently the tuft or spot lies opposite to a bare patch or to a similar

[1] This designation is justified by the pupa of our *P. nephalion*, which lives on *Aristolochia*, and is entirely similar to that of *Ornithoptera heliacon*.—F.M.

brand on the other wing or on the abdomen. Where brands or tufts lie free on the surface of the wings, they are on the upper side, so that in this case, when the butterfly rests with raised wings, they are hidden between them. They never appear to occur on the under side of the hind-wings, or on that part of the fore-wings left uncovered by the hind-wings. The scales of the "brands" are usually placed very close together and therefore stand almost upright, and are fastened far more securely than the ordinary scales of the wings. After removal of the scales the patches are recognizable not only by the densely packed points of attachment of the scales, but the membrane is also as a rule more or less cloudy or even dark coloured. Not infrequently they are traversed by arborescent *branched or net-like air-tubes.* The *tufts, manes* or *bunches of hair* concealed between the wings, or between wings and abdomen, tend to erect themselves when the wings are opened out or drawn away from the abdomen. Possibly all the tufts which lie free on the surface of the wings may be also capable of voluntary erection; in *Opsiphanes cassiae* the tuft lying in the middle of the cell of the hind-wings can be spread out into a complete hemisphere.

By far the most common structure—a brand or tuft on the costal margin of the hind-wings, between the costal and subcostal [nervures], and covered by the inner margin of the fore-wings, occurs in such extremely different insects,[1] that inheritance from a common ancestor is scarcely to be thought of, for such inheritance would necessarily imply, not only that the structure existed in the male of the original ancestral form of all diurnal Lepidoptera, but that it has been lost by the majority of his descendants. But with almost equal right one would also have to ascribe to this original male the patch or hair-tuft on the inner margin of the hind-wing, which occurs in the *Danainae*, *Satyrinae*, *Morphinae*, *Brassolinae* and *Nymphalinae,* and in a kindred form in the *Papilionidae*. It is far more probable that the furnishing of the males with special scale brands and hair-tufts occurred at a later stage and independently in the several groups. An argument in favour of this is the great variety to be seen within the same family, or even in the same genus (*Mycalesis*). Whatever, therefore, these brands and tufts, scattered through the most widely separated groups of diurnal Lepidoptera, possess in common, must, since it can scarcely be traced back to a common source, be considered as an adaptation to some similar purpose. As to what that purpose is, not even conjectures have, as far as I know, been made public hitherto [1876].

Chance revealed to me the meaning of the brands and hairs in a single species, and I presumed that these structures would have the same significance in all, a presumption I have since been able to confirm by the study of several species belonging to different families.

[1] In *Danainae* (*Euploea*, *Ithomia* and their allies); in *Satyrinae* (*Mycalesis*, *Bia*); in *Morphinae* (*Zeuxidia*); in *Brassolinae* (*Opsiphanes*); in *Nymphalinae* (*Lachnoptera*); in *Pierinae* (*Leptalis*; *Callidryas*); and in *Hesperidae* (*Caecina*).—F.M.

I had caught a freshly emerged male of *Callidryas argante*, and, in order to show to a friend the mane-like pubescence of the hind-wings, I drew the fore- and hind-wings apart. I then perceived a distinct, somewhat musky, scent, and convinced myself that it came from the hairs, which erected themselves as the wings were parted. This observation I have repeated with numerous males of the same species, and it was only with old, worn and battered specimens that the scent could not be perceived. I have since had opportunities of smelling only a few similarly equipped butterflies. On one male of *Prepona laertes*, I found a not very strong, but yet unmistakable scent, arising from the tuft on the hind-wings. Several of my children not only perceived the same scent, which they (very appropriately, I consider) spoke of as bat-like, but they also pointed to the same spot as its seat. A male of *Dircenna xantho*, gave off a not strong, agreeable, vanilla-like scent; here also, I asked my children to seek for its source, which they agreed with me was to be found in the "hair-tuft." Far more powerful than in the three above-named species is the scent, bat-like, as in *Prepona*, which proceeds from the large black patches on the fore-wings of one of the finest of our *Theclas* (*T. atys*, Cr.). This odour can be distinctly perceived even several weeks after death. The upper side of the fore-wings in the male of this *Thecla* is blue, bordered with black; the black border widens from the posterior angle, where it covers about one-fifth of the length of the wing, to the apical angle, where it covers about one-third; the anterior margin is also black as far as the costal nervure. In the central blue area are two large, deep black patches, separated by a blue streak, marking the position of the transverse vein which closes the cell. Thus one patch, the smaller, lies inside, the other, the larger, outside the cell. The inner is pentagonal with rounded corners, and entirely occupies the end of the cell, extending along the subcostal nearly to the origin of its first branch, along the third branch of the median about half as far, and bounded at the base by two lines which meet at right angles on the aborted basal part of the discoidal. The outer patch, separated from the inner by the transverse veins, touches in front the upper discoidal vein, and behind the second branch of the median, surpassing the inner spot in this direction by about one-third. It forms an oblique-lying oval area, whose axes are about as 5 to 6. The lower discoidal and the median intersect it, and from each of the sections thus formed a triangular blue spot extends into the black border of the wing. The surface of these patches amounts to about one-tenth of the entire wing. Their closely packed scales adhere very strongly, and after removal, the outer patch is translucent with a slightly yellowish tint, the inner very dusky and almost opaque; the membrane of the latter bulges somewhat on the lower surface of the wing. On microscopic examination the outer patch shows, besides the crowded sockets of the scales, only a few delicate, scarcely branched air-vessels, which enter it from the neighbouring nervures. On the other hand, one sees in the inner patch (especially

when looked at from beneath) a rather close net-work of largish air-vessels, with red-brown, *transparent points enclosed in the meshes.*

The brand on *Callidryas argante* is also traversed by branched arborescent air-vessels. It is somewhat paler than the surrounding area, from which it is not sharply demarcated, but after removal of the scales it stands out more distinctly as a dull spot. This brand lies in the obtuse angle between the subcostal and its branch, and is separated by a pale border from both veins, from which air-vessels pass into it. It is about 3 mm. long, by 0·6 mm. in greatest breadth. The mane which covers the spot is composed of hairs of about 5 mm. long, arising from a strip, about 1·3 mm. in breadth, which extends from the base of the cell for about 10 mm. along the subcostal.[1]

Having therefore demonstrated by actual observation that the purpose of the patches and hair-tufts in the males of *Callidryas argante, Thecla, Prepona laertes* and *Dircenna xantho*, species from widely differing families, is to exhale scents, which are probably agreeable to their females and entice them to pair, I am led to infer that this is the meaning of all similar structures on the wings of male Lepidoptera, not only because of *the unmistakable similarity amidst such great diversity*, but even more on account of the previously mentioned peculiarities which render them especially suitable for such a purpose. They are usually sheltered from exposure to the air, enclosed between the fore and hind wings or in some other manner, or at least, while at rest, concealed between the closed upright wings. Thus the scent is not diffused at the wrong time and so wasted, but collects between the densely packed scales, among the hairs, brushes or manes. One could hardly find a more effective method of employing any odoriferous substance, than that of saturating with it the hairs of a brush, and then suddenly opening them out in all directions, so as to provide an enormous surface for evaporation.

Just as the Ageronias, four species of which I had an opportunity of observing in some numbers during the past summer, only make the remarkable crackling sound on the wing and during courtship, so also in all probability, the butterflies equipped with brands, tufts, etc., only distribute their scent under the same circumstances.

I recently captured a pair of *Hesperia orcus*, which were fluttering close together, and appeared to be almost on the point of pairing. When I took out the male, which had been killed by a pinch while still in the net, I found that the costal fold of one side was raised and spread out in the plane of the wing. I had never seen such a thing on any other

[1] *Argante* is accompanied in this locality by a very similar paler species or variety which agrees very well with Boisduval's description of *C. agarithe*, and emits a scent just like that of *argante*. The brand in this form is larger, not only extending to the subcostal and its branch, but filling the acute angle between these two nervures. Among the specimens I happen to have in hand, I find no transition forms between the two.—F. M.

occasion, either in the male of *orcus* or of any other Hesperid, and I could not understand how by pinching the thorax I had brought about the unfolding. Probably it had been already accomplished by the ardent male himself.

From the very first I never expected to find in all the above-mentioned species any striking scent, or indeed one that would be perceptible to the human nasal organ. Our sense of smell is very imperfectly developed, even in comparison with many mammals, and its inferiority may be far more pronounced when compared with certain insects, especially Lepidoptera. It is well known that the females of Moths attract the males from almost incredible distances; and the certainty with which butterflies are able to discover the food-plants of their larvae, suffices to prove the keenness of their scent. Thus, to the female butterfly a scent which is not perceptible to the human nose, may appear quite strong. I was, therefore, not surprised at being unable to detect any scent from the brands of several species of *Thecla*, or from the large, mane-covered chalky patch of *Callidryas trite*,[1] and I do not find in this inability any objection to my explanation as to the purpose of such structures.

I may be permitted to take this opportunity of also mentioning some other scent-distributing organs of diurnal Lepidoptera.

The males of most species of *Glaucopidae* are able to protrude two long hollow tubes from the apex of the abdomen. Sometimes (*Leucopsumis* sp.) these tubes are longer than the body, and on protrusion curl up like rams' horns. They are as a rule beset with hairs, which are erected in the act of protrusion, and they usually give off a more or less powerful, and to us unpleasant, smell: especially strong, and in this case not unpleasant, is the scent of the magnificent *Belemnia inaurata* (*Euchromia eryx*), recalling at the same time prussic acid and chloroform. Entirely similar, strong smelling tubes I found in a moth, the name of which I do not know.[2]

With all their external differences, these tubes of the male *Glaucopidae* are adapted to fulfil the two requirements of a scent-distributer which we noted in the butterflies :—protection against unnecessary evaporation, and the exposure of a large surface, when the scent is to be emitted.

It is worth noting that within the group of the *Ithomiinae* and their allies, both these structures occur, and appear to represent each other. In *Lycorea*[3] the tuft on the anterior margin of the hind-wing, which occurs in most of the Ithomiine genera, is wanting; but then the males possess

[1] See terminal note, p. 615.

[2] Identified by Dr. Staudinger as a species of *Cryptolechia*.—F.M. [The classification and synonymy of the moths referred to in the above paragraph have been entirely changed since the date at which this memoir was written. *Glaucopis* = *Syntomis*. *Leucopsumis* is a Hypsid, *Belemnia* an Arctiid, *Euchromia* a Syntomid. See also *Nature* (1874), p. 102, for a letter dealing with the *Glaucopidae*, written April 20 [1874], by F. Müller to Charles Darwin.—E.B.P.]

[3] See note 1 on p. 605.

at the apex of the abdomen a partially retractile bunch of hair. Similarly among the *Pierinae*. Here, too, there are species—one at least is known to me—in which the scent originates, not in the wings, but from the apex of the abdomen. The male of *Daptonoura ilaire* possesses on the ventral surface, just anterior to the anal valvulae, a non-retractile brush of hair, about 4 mm. in length. The brush when at rest, is closely pressed to the ventral margin of the anal valvulae, extending slightly beyond them. By pressing the abdomen it can be spread out on all sides, and then emits a very distinct, though feeble scent. I have never taken the female of this species, but do not doubt that the brush of hair occurs only in the male, and that the scent serves to attract the opposite sex, and not as a warning to foes. Scents which serve this latter purpose are usually given off instinctively by the insect as soon as it is captured. Thus the females of various "Maracujá butterflies" (*Heliconius, Eueides, Colaenis, Agraulis*) when seized, protrude from between the seventh and eighth dorsal plates two fleshy glands, which meet along the middle dorsal line, and exhale a more or less penetrating scent, while the male, under similar circumstances, separates the anal valvulae, on the inner side of which similar glands are situated. If one catches a male of *Didonis biblis*, it protrudes on the dorsal surface, between the fourth and fifth segments, two roundish bodies, meeting along the centre line, covered with short grey hairs and emitting a scent: pressing the abdomen causes the protrusion of two similar bodies between the fifth and sixth segments; these are beset with longer white hairs, which on protrusion radiate in all directions. I regret that I have not been able to ascertain whether such glands exist in the female.

The *Ithomiae* of the Amazon, which have been made so celebrated by Bates as the models for *Leptalis* and other mimicking Lepidoptera of that locality, are said to be protected against birds by a disagreable scent. Is this the same scent as that emitted by the closely allied *Dircenna xantho*, and is it emitted by the hair-tufts of the males? If that were so, one could understand the hundred-fold predominance of the males recorded by Bates, and the entire correspondence between the sexes in pattern and colour. If the possession of a scent repulsive to pursuers were confined to the males, and the sexes in equal numbers, then their enemies would secure a palatable mouthful just as often as a disagreeable one, and would scarcely be induced to give up the capture of *Ithomiae*. But this would follow the more surely according as the males predominated, and the less often the chase resulted in an agreeable morsel. Again, the females, being indistinguishable from the males, would, although wanting the protective scent, share in the security which the males owe to their tufts. Hence, in this case, the similar coloration of the sexes confers upon the female a protective resemblance, established and maintained by natural selection, as in the mimicking *Leptalis*.

I close with the hope that investigators who have access to rich collections will give us further information regarding the distribution of

these structures and their minute anatomy, and that observers of living insects will soon add to our knowledge of the scent emitted by tufts, brands, and similar structures. To urge such investigations is the sole object of these lines, for that which I am myself able to offer is scarcely worth recording.

Itajahy, Santa Catharina, Brazil, April, 1876.

SUPPLEMENT.

In the course of the last month, in addition to a crowd of male *Didonis biblis*, which are taken almost daily in quantity, I have had the opportunity of examining also a fair number of females, which are, at least in this locality and at this time, far rarer than the males.

The females possess only the two anterior glands, the posterior pair being entirely absent: the anterior glands are rather smaller, the hairs or rather the hair-like, battledore-ended scales, are fewer than in the male, but the scent is not less powerful. This smell, as also that of the corresponding anterior glands of the male, was pronounced almost unanimously by my children to be disagreable, and even repulsive, whereas that of the posterior pair in the male was unanimously described as agreeable, and flower-like, recalling heliotrope. These posterior white glands, wanting in the female, stand out so sharply on the black abdomen, that they look attractive, and it seems probable that they charm the female not only by their scent, but by their ornamental appearance. This would also apply to the patches on the fore-wings of the males of *Thecla*, when they show up light on a dark ground, or glow with lustrous blue, as in *Thecla bosora*.

May, 1876.

Fritz Müller's important paper, read June 5, 1878, "Odours emitted by Butterflies and Moths" (*Trans. Ent. Soc.*, 1878, pp. 211–221), may be looked upon as a further supplement to the above memoir. See also the discussion in *Proc. Ent. Soc.*, *1878*, p. xxvii. The following extract from a letter to his brother Hermann Müller is published in Carus' *Zool. Anzeig.*, I. (1878), p. 32:—

"It appears, that from constant practice, my nose is becoming ever keener. With *Daptonoura lysimnia* I now detect an agreeable scent from each newly captured male. Two years ago I always found *Callidryas trite*, male, devoid of scent: yesterday I caught a male with a distinct smell. In *Didonis biblis*, male, the black patch on the under side of the fore-wing also smells like faint musk, so that this creature develops three different scents. In *Callidryas*, the female also has strongly scented glands on the genitalia, which, when excited, she exserts: their odour is sharp [or acid], that of the male, musky."

Itajahy, April 16 [1878].

An interesting review of the above memoir (§ I.), signed "K" — probably Dr. Ernst Krause — is to be found in *Kosmos*, I. (1877), pp. 260, 261.—E.B.P.

§ II. *On the Sexual Spots of the Males of* Danais erippus *and* D. gilippus.[1]

PLATE A.

IN the account which he gives of the generic characters of *Danais*, Doubleday[2] makes the following statement as to the sexual differences which are found on the wings of these butterflies :—

The males of the first group (containing the African species now included in the genus *Amauris*[3]) "have a patch of peculiarly formed and closely placed scales situated on the submedian nervure of the posterior wings, not far from the anal angle." In the second group (to which belong all the American species) the "sexual spot" is found on the first branch of the median nervure. In the third group the sexual spot is placed either on the same branch or on the submedian nervure, and is in the form of a perfect pocket, opening on to the upper surface of the wing, at the bottom of which, at least in dried specimens, a little dark powder is found. In the species of the fourth group (now forming the genus *Ideopsis*[4]) the sexual patch is absent from the hind-wings.

Recent discoveries[5] show that the sexual marks which characterize the wings of many male butterflies are scent-organs, and they exhale at times a distinct odour, which is undoubtedly agreeable to the females of the respective species. I therefore proceeded to examine the sexual spots of our two species of *Danais* (*Danais erippus*, Cram. and *D. gilippus*, Cram.) and found in them a most interesting structure, which appears to me worthy of detailed description. The "sexual spot" (I provisionally retain Doubleday's name for the structure until its functions are definitely ascertained) is placed, in our *D. erippus* and *D. gilippus*, on the hind-wings, between the submedian nervure and the first branch of the median, being only separated from the latter by a very narrow interval, which in *D. erippus* barely equals, and in *D. gilippus* scarcely exceeds, the diameter of the branch itself (Pl. A, Figs. 1, 2, 7, 8). It is visible on both sides of the wing, forming a small black swelling more prominent on the upper surface. The

[1] *Archivos do Museu Nacional do Rio de Janeiro*, II. (1877), pp. 25–29. By Dr. Fritz Müller, Travelling Naturalist for the National Museum.

[2] Doubleday, Westwood, and Hewitson, *Genera of Diurnal Lepidoptera*, p. 89.—F.M.

[3] Kirby, *A Synonymic Catalogue of Diurnal Lepidoptera*, 1871, p. 8.—F.M.

[4] Kirby, *loc. cit.*, p. 2.—F.M.

[5] Fritz Müller, *Kosmos*, I., 1877, p. 391 [see § X., p. 655].—F.M.

black colour is not due to the covering of ordinary scales only—for it persists when they are removed—but to the membrane itself, which at this part is both darker and of a firmer consistence. The sexual spot is elliptical in shape, with the major axis parallel to the nervure. It is much larger in the smaller species, viz. *D. gilippus*, being about 4 mm. long, by from 1·5 to 2 mm. wide; while in *erippus* it rarely exceeds 2 mm. in length, by 6 [0·6 is evidently intended] in width. The sexual spot is shaped like a leaflet of wood-sorrel [usually called "obcordate"], and forms, as Doubleday described in some species of his third group of the genus *Danais*, a kind of pocket, opening on the upper surface of the wing, where there is, on the posterior margin of the spot, a narrow slit occupying half, more or less, of its length. The lower wall of this pocket or cavity is formed by the actual membrane of the wing; the upper wall is separated from the lower, a little distance from the nervure, at a very acute angle. The free or posterior margin of this wall curves or rolls round towards the interior of this cavity, as is well seen in transverse sections (Pl. A, Figs. 3 and 9).

I have noticed that in the living insect the free margin of the upper wall is pressed closely against the lower wall, thus closing the cavity on all sides; yet it is easy to pass through the slit which separates the walls some slender object, as may best be understood by means of Figs. 3 and 9. The membrane of the wings of insects is composed, as is well known, of two layers which generally adhere together. These two layers exist also in the walls of the spot, or, to express it better, of the sexual cavity, but may *easily be separated*, and, *in fresh specimens, usually have between them* a good deal of blood. The external layer, as already stated, is tough [*indurated* or *hardened*], *black*, and *covered with ordinary scales*. The internal layer, which is much thinner than the other, presents a somewhat different aspect in our two species.

In *D. erippus* it exhibits small circles of about 0·01 mm. diameter, a little more transparent than the rest of the membrane. From the centre of each rises a straight hair, about 0·06 mm. long. The circles are placed in regular lines, about 0·03 to 0·06 mm. apart. Alternating with these circles are opaque grey scales, distinguished from the ordinary ones by their smaller size and by their shape (Pl. A, Fig. 4).

In *D. gilippus* (Pl. A, Fig. 10) the circles are much closer together—so much so that in places they almost touch: although more transparent than the rest of the membrane, they are less so than those of *D. erippus*. The hairs are wanting, but one sees in the centre of each circle a small spot, the last vestige which proves their former existence. The scales are far smaller than those of *D. erippus*, being about 0·04 mm. in length, as compared with 0·08. Probably these little scales are the "grey dust" found by Doubleday in certain other species of *Danais*.

It is not possible to detect any odour arising from the wings of the males of either of the two species found in the Province of S. Catharina,

but before passing on to discuss the biological significance of the sexual spots it will be well to describe briefly another organ, peculiar to the male sex, which appears to have hitherto escaped the attention of entomologists. If one strongly compresses the abdomen, there is everted on each side of the last segment a finger-shaped membranous tube with closed apex (Pl. A, Figs. 6 and 12), which is covered with dark hairs, erected as the tube passes out of the abdomen, and exhaling at the same time a somewhat strong odour in *D. gilippus*, and one less strong, though still perfectly distinct, in *D. erippus*—a difference which evidently depends upon the fact that the hairs are far more numerous, as well as thicker and longer, in the first-named species. On being withdrawn into the abdomen, the tube is turned outside in or introverted, so that the surface which was external becomes internal, forming a sheath or case round the hairs, which then appear to spring, in the form of a tuft, from the bottom of the tube.

Such are the facts. It remains to discuss them. The wings of many species of butterflies bear, in the male sex only, scales of peculiar form, often collected together in well-defined patches, and in some cases concealed in furrows or folds of the wings—scales and patches which undoubtedly act as scent-organs. It appears probable that the modified scales concealed in the cavity of the sexual spot in *D. erippus* and *gilippus* serve, or may have served, the same purpose. It may perhaps be possible to find among the different species of *Danais* intermediate forms, linking the pockets of the American species with the patches which are seen on the hind-wings of the males of *Amauris*.

Further, not only is there no perceptible scent exhaled from the wings of the male *D. erippus* and *gilippus*, but it appears extremely unlikely that such a function would be exercised by a cavity communicating with the air only by a narrow slit, and, in addition, having apparently no mechanism on the wing by means of which it could be opened; and as there are, at the extremity of the abdomen, organs whose scent-distributing functions cannot be doubted, it is natural to conjecture that the sexual spots of *D. erippus* and *gilippus* are scent-organs reduced to a rudimentary state by the development of the other organs at the apex of the abdomen, which better fulfil the same functions. We might cite in support of this conjecture certain analogous facts which exist in other families of butterflies. On the other hand, the blood in the walls of the sexual cavities—present in an amount that is rare in the wings of these insects—appears to forbid us to consider them as rudimentary organs, and the facts may perhaps be met by the supposition that the development of the wing-organs is in inverse ratio to that of the abdominal organs, and that they may show themselves sometimes more, sometimes less developed. Whether this is correct or not remains to be seen.

In *D. gilippus* these organs, both of the wings and of the abdomen, are far larger than in *D. erippus*, in spite of the latter species being much the larger of the two.

In doubtful cases one must not pass over any circumstance, however unimportant it may appear, and I therefore mention the fact that in some males of *D. erippus*, otherwise perfect, a very small portion of the wing, close to the orifice of the sexual cavity, was entirely denuded of scales, as if they had been repeatedly rubbed away by introducing something into the slit. Is it not possible that some odoriferous substance may be produced in the interior of the sexual spot, and that the hairs of the abdominal organs introduced into its cavity may become impregnated with this substance ?

The position and shape of these sexual cavities is such that the extremity of the abdomen might easily be applied to them, and as the hairs of the abdominal organs unite in the form of a brush, it would not be impossible, or even difficult, to introduce them into the depths of the cavity.

I confess, frankly, that this idea appears to me to be well founded, but it is only by a comparative study of the numerous species of *Danais* that we can arrive at a definite solution of this interesting problem.

EXPLANATION OF PLATE A.

The Figs. 1–6 refer to *Danais erippus*, male; 7–12 to *D. gilippus*, male.

Figs. 1 and 7.—Hind-wing, upper surface, natural size. The numbers of the nervures are those of Herrich-Schaeffer, but the nomenclature is that of Doubleday.

1*a*, internal nervure.
1*b*, submedian nervure.
2, first branch of the median nervure.
3, second ,, ,, ,,
4, third ,, ,, ,,
5, discoidal nervure.
6, second branch of the subcostal nervure.
7, first ,, ,, ,,
8, costal nervure.
p, precostal nervure.
s, sexual spot (Doubleday).

Figs. 2 and 8.—The sexual spot, magnified 5 times.

n, first branch of median nervure.
s, sexual spot.

Figs. 3 and 9.—Transverse section of the sexual spot, magnified 15 times.

n, first branch of median nervure.
i, lower wall of the cavity of the sexual spot.
s, upper ,, ,, ,,

Figs. 4 and 10.—Part of the inner membrane of the cavity, magnified 180 times.

a, points of insertion of scales.
b, one of the scales.
c, points of insertion of the hairs, which are wanting in *D. gilippus*, only the points [of insertion] remaining.

Figs. 5 and 11.—Ordinary scales from the upper surface of the hind-wings, magnified 180 times.

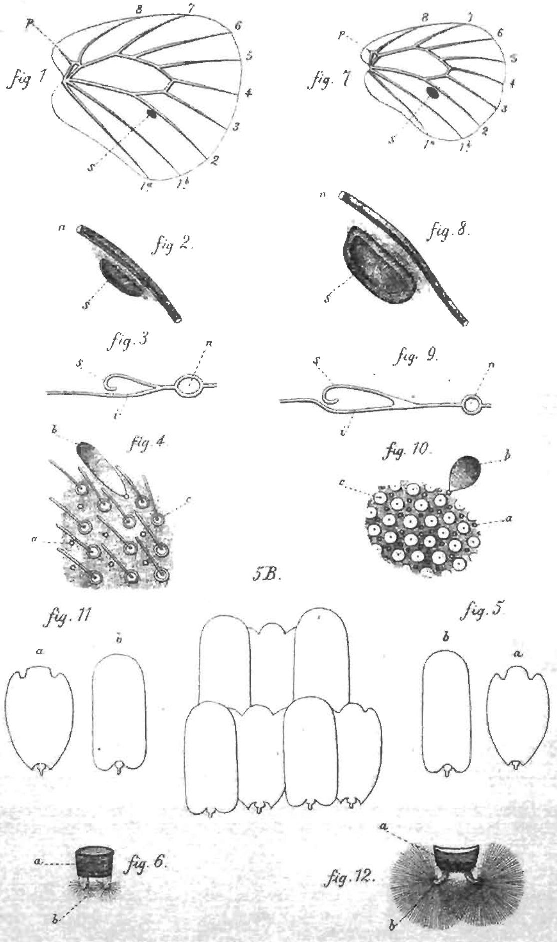
a, lower scales.
b, upper scales.

Fig. 4*b*.—One of the same scales in its natural position.

[Fig. 5*b*.—Is not mentioned in text or explanation; it undoubtedly represents the arrangement of the scales shown separately in Fig. 5, viz. those of *D. erippus*.—E.A.E.]

Figs. 6 and 12.—Scent-organ, seen from above, twice the natural size.

a, last abdominal segment.
b, scent-organ.



Fritz Müller del. West, Newman photo-lith.

SCENT ORGANS OF MALE DANAIS ERIPPUS AND D. GILIPPUS.

§ III. *On the Scent-organs of the Butterflies,* Epicalia acontius, *Linn., and* Myscelia orsis, *Drury.*[1]

PLATE B.

THE [Nymphaline] genus *Epicalia*, Westw. (or *Catonephele*, Hübn.), has acquired a certain celebrity (Darwin, *Descent of Man*, 1871, vol. i. p. 388) from the extraordinary difference in colour exhibited by the two sexes in many of its species. Thus, if we compare *Epicalia numilia*, Cram. with *E. acontius*, L., we see that the females of the two species, and in like manner the males, resemble each other far more closely than do the females their respective males. The males of both these species are ornamented with large and splendid orange markings on a ground of black velvet. *E. numilia* has three separate elliptical spots (two on the fore-wing and one on the hind), while *E. acontius* (*antiochus*, Fab.) has one such spot on the fore-wing, uniting with one on the hind to form a band crossing both wings. In the females the wing spots are of a sulphur yellow and of an entirely different shape from those in the opposite sex: in *E. acontius* (*medea*, Fab.) they are very numerous and are arranged in three parallel lines. In fact, the differences between the two sexes are so great, that Westwood placed them in different genera, giving the name of *Myscelia medea* to the female of *Epicalia acontius*.

The two species which I have just mentioned—the only Epicalias as yet met with in the province of Santa Catharina, are most interesting, inasmuch as the males, which are otherwise very similar, exhibit the most remarkable differences in respect to their scent-organs. In the males of *E. numilia* I have not found it possible to detect the slightest vestige of such organs, and they appear to be entirely wanting in these insects. In the males of *E. acontius*, on the contrary, they attain a somewhat unusual degree of development, and exhale a very strong odour. These scent-organs are hidden between the fore and hind-wings, occupying the upper surface in the latter, the lower in the former. On the hind-wings there is seen (Pl. B, Fig. 11), close to the orange spot (*b*) a still larger patch of grey colour (*m*), which lacks the velvety appearance of the rest of the wing, and may rather be compared to a kind of felt. This felted patch ("Filzfleck," Herrich-Schaeffer) is bounded by the dorsal [costal] (8) and

[1] *Archivos do Museu Nacional do Rio de Janeiro*, II. (1877), pp. 31–35. By Dr. Fritz Müller, Travelling Naturalist for the National Museum.

discoidal [radial or second discoidal] (5) nervures, and [within the cell] by a line from the point of separation of the costal and subcostal to the point at which the lower discocellular leaves the discoidal; it runs along the costal nervure for about two-fifths of its length, and along the discoidal to a point midway between the margin of the wing and the point of separation of the costal and subcostal. This spot occupies about one-eighth of the surface of the wing, being nearly a semicircle of 12 mm. diameter, while the whole wing is about equal to a circle of 24 mm. diameter.

This patch is usually covered by the fore-wing, the lower surface of which is provided (Pl. B, Fig. 11, *m'*) with a patch, opposite to that on the hind-wing, and almost identical in its felted appearance, colour, form, and size. It is, however, less conspicuous, not only from contrasting less with the colour of its surroundings, but also from being entirely covered with a mane of black hair, inserted along the internal [submedian] nervure (1). This felted patch on the fore-wings extends from the internal [submedian] nervure (1) to the angle formed by the second and third branches (nervures 3 and 4) of the median, and, as in the hind-wings, an insignificant part of the patch enters the cell.

The mane, which has been just mentioned, starts from the posterior margin of the patch, or, what comes to the same thing, from the anterior margin of the internal [submedian] nervure. If this nervure be considered as divided into five equal parts, the second and third of these parts, counting from the base of the wing, are occupied by a mane composed of fine [in the sense of "beautiful"] black hairs of about 7 mm. in length. This mane covers exactly and entirely the felted patch of the fore-wings, and at the same times separates it from that on the hind.

The scales of the felted, or odoriferous patch (Pl. B, Fig. 13) are distinguished from ordinary scales (Fig. 12).

First, by their shape, which chiefly differs in the non-dentate ends.

Second, by their size. Of the ordinary scales on the upper surface of the wings, the overlying (Pl. B, Fig. 12 *s*) run about 0·14 mm. in length by 0·06 mm. in breadth; the underlying (Fig. 12 *i*) about 0·1 long by 0·08 broad. The overlying scent-scales (Fig. 13 *s*) measure from 0·33 mm. long by 0·1 broad; the underlying (Fig. 13, *i*) about 0·24 long by 0·11 broad.[1]

Third, in being much more opaque and apparently without the longitudinal lines found on ordinary scales.

Fourth, in being more firmly fixed to the membrane of the wing, so that by passing a brush over the surface of the wing, one can remove the ordinary scales and leave those of the felted patch.

All these differences between the ordinary and the scent-scales exist in nearly every species which bears scent-patches upon its wings. The

[1] The reference letters *s* and *i* are accidentally transposed in Fig. 13 of the original plate.—E. B. P.

characters which distinguish the patches of *E. acontius* from those of most other species are as follows :—

First, the difference which is observed between the over- and underlying scales; for it is the general rule for the scent-scales to be all of one form, without any distinction between the upper and lower.

Second, the fact that the pits or sockets in which the scales are implanted are placed at about the same distance apart on the scent patches (Pl. B, Fig. 15) as on the rest of the wing (Fig. 14); whereas, as a rule, the scent-scales are more closely placed than the ordinary ones.

The pits of the scent-scales are larger, and surrounded by a dark elliptical or circular area, as is also frequently seen in other species.

Again, it is worth noting that a considerable modification in the shape of the wing accompanies the development of the scent-patches. The inner (or posterior) margin of the anterior wings is nearly straight in the females of *E. acontius* (Pl. B, Fig. 10), and in both sexes of *E. numilia* (Fig. 9), but in the males of *E. acontius* (Fig. 11), it is greatly arched, and in such manner as to cover a much larger part of the lower wings. In a similar manner the costal border of the hind-wings is enlarged. Hence it follows that in the female of *E. acontius* (Fig. 10) the form of the wings approaches more nearly to that of the male *E. numilia* (Fig. 9) than to that of its own male (Fig. 11).

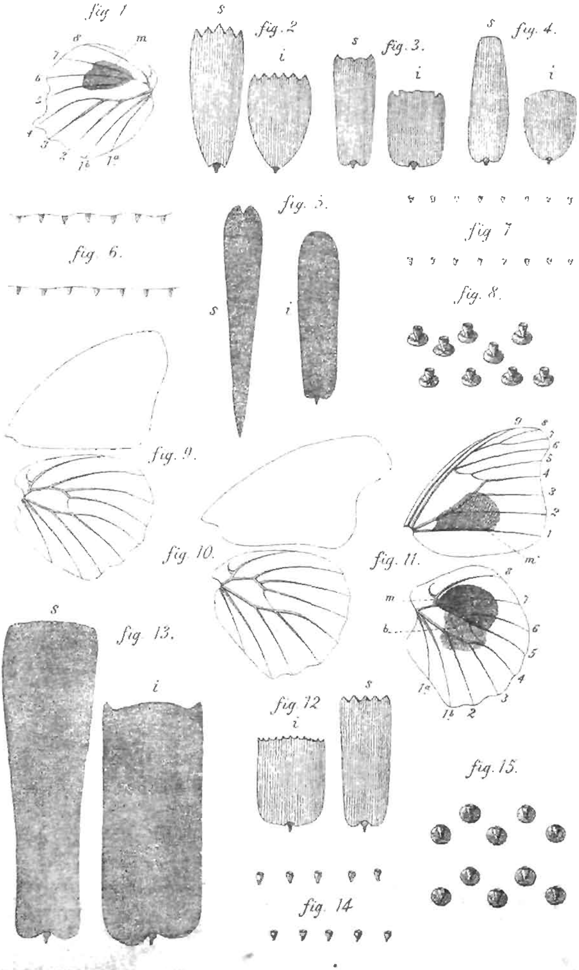
Closely allied to *Epicalia* is the genus *Myscelia*, represented in the province of Santa Catharina by *M. orsis*, Drury. I have recently been able to examine a male of this species, in which Herrich-Schaeffer[1] describes a felted spot ("filzfleck") on the upper surface of the hind-wing (Pl. B, Fig. 1 *m*), between the fifth and seventh nervures, that is to say, between the discoidal [radial or second discoidal] and the first branch of the subdorsal [subcostal]. It required little to convince me that the above-mentioned patch exhales a strong scent, which, like that of *E. acontius* male, greatly resembles musk. The patch, which occupies about one-ninth (36 square mm.) of the surface of the wing (315 square mm.), also extends a little beyond the nervures which Herrich-Schaeffer assigns as its limits. Its colour is entirely black, while the surrounding area of the wing, which, like the spot, is overlapped by the fore-wing, is greyish, the disc being of a brilliant blue. The structure of the patch differs little from that of *E. acontius*, and it is therefore unnecessary to give any detailed description. The scent-scales differ in that they do not greatly exceed the ordinary ones in size, while the fore-wings are destitute of scent-organs.

Thus, in respect to the felted patches, the male of *Myscelia orsis* occupies an intermediate position between *Epicalia numilia*, which has no such structures, and *E. acontius*, which bears them on the fore-wings as well as the hind. In view of these facts, it is permissible to doubt whether any

[1] *Prodrom. Syst. Lepidopt*, fasc. i., 1864, p. 27, No. 79.—F.M.

definite line of division between these two genera has been proved to exist. As regards the females also it is well known that *M. orsis* and *E. acontius* agree perfectly in the arrangement of the spots on the wings, spots which, entirely yellow in the latter, white in the former species, are very different from those of the female of *E. numilia.* This comparison of the female patterns may further contribute to strengthen the doubt expressed above.[1]

[1] See also Fritz Müller's paper on "*Epicalia acontius.* An unequal pair" (*Kosmos*, IV. (1878–9), pp. 285–292), of which an abstract by H. Müller appears in Carus' *Zool. Anzeig.*, I. (1878), p. 13.—E.B.P.



Fritz Müller del. West, Newman photo-lith.

SCENT PATCHES AND SCALES OF MALE MYSCELIA ORSIS &c

EXPLANATION OF PLATE B.

The Figs. 1, 9, 10 and 11 are natural size, the rest magnified 180 times.

The Figs. 1–8 refer to *Myscelia orsis*, male. Throughout the plate, *s*, upper, *i*, lower scale.

Fig. 1.—Hind-wing of *Myscelia orsis*, male. *m*, felted or scent patch.

Fig. 2.—Scales from the lower surface of the [hind-] wing.

Fig. 3.—Scales from the disc of the upper surface.

Fig. 4.—Scales from the hind margin of the upper surface of the hind-wing.

Fig. 5.—Scales from the felted spot.

Fig. 6.—Sockets of scales on the lower surface of the hind-wing. As in many other species, the sockets of the lower surface differ from those of the upper by being joined by a thread.

Fig. 7.—Sockets of the ordinary scales on the upper surface of the hind-wing.

Fig. 8.—Sockets of the scent-scales.

Fig. 9.—Outline of the wings of *Epicalia numilia*, Cram., male.

Fig. 10.— ,, ,, *Epicalia acontius*, Linn., female (*medea*, Fabr.).

Fig. 11.—Outline of the wings of *Epicalia acontius*, Linn., male (*antiochus*, Fabr.).

b, orange spot on hind-wing.
m, felted spot on same wing.
m', felted spot on the lower surface of the fore-wing, covered by a mane of black hairs.

Fig. 12.—Ordinary scales from the upper surface of the disc of the hind-wing of *Epicalia acontius*, male.

Fig. 13.—Scales from the felted spot on the same wing.[1]

Fig. 14.—Sockets of the ordinary scales on the same wing.

Fig. 15.—Sockets of the scent-scales on the felted spot of the same wing.

[1] The reference letters *s* and *i* are accidentally transposed in Fig. 13 on the original plate.—E.A.E.

§ IV. *On Scent-organs on the Legs of certain Lepidoptera.*[1]

PLATE C.

DARWIN, speaking of sexual selection, and the secondary sexual characters of insects, makes the following statement :—

"The sexes of many species in all the orders present differences, of which the meaning is not understood. . . . They abound in the Lepidoptera: one of the most extraordinary is that certain male butterflies have their fore-legs more or less atrophied. . . . The wings, also, in the two sexes often differ in neuration, and sometimes considerably in outline, as in the *Aricoris epitus*. . . . The males of certain South American butterflies have tufts of hair on the margins of the wings, and horny excrescences on the discs of the posterior pair. In several British butterflies, as shown by Mr. Wonfor, the males alone are in parts clothed with peculiar scales."[2]

Almost all these sexual differences in the Lepidoptera—completely inexplicable only a few years ago—have now become clear and intelligible since the discovery has been made that they are directly or indirectly concerned with the production or diffusion of a peculiar scent which must certainly be agreeable to the females. Foremost in this category are, first, the tufts or manes which are frequently found on the anterior margin of the hind-wings, and produce a scent which is strongest in *Callidryas cipris*, but very perceptible and very agreeable in *Dircenna xantho* [*Ithomiinae*], and in other species; secondly, the "specialized scales" of very varied forms, which exist on the wings of the males of many species of *Satyrinae, Heliconinae, Nymphalinae, Pierinae*, etc., to which Bernard Deschamps[3] gave the name of "plumules"; thirdly, the "horny excrescences" or "sexual spots" which are seen on the disc of the hind-wings of *Danais erippus*, and *gilippus*.[4]

As to the sexual difference in the disposition of the wing venation, this also, in most, if not in all cases, owes its existence to the male scent-organs, which in some way displace certain nervures; as may be easily verified in the genera *Dircenna, Mechanitis, Thecla* (*e.g. T. acmon*), among diurnal,

[1] *Archivos do Museu Nacional do Rio de Janeiro*, II. (1877), pp. 37–42. By Dr. Fritz Müller, Travelling Naturalist for the National Museum.

[2] *Descent of Man*, 2nd Edition, 1874, pp. 276, 277.—E.B.P.

[3] *Annales des Sc. Nat.* 1835, III., p. 120. Quoted by Chenu, *Encyclop. d'Hist. Nat. Papillons*, I., p. 8.—F.M.

[4] In the *Jen. Zeitschr.*, XI. (1877) [viz. § I of this Appendix], is published a *résumé* of what our authors have written, which may be consulted as to scent-organs on the wings of butterflies, and is the first attempt to demonstrate the functions of these organs.—F.M.

and in *Rhamphidium*, among nocturnal, Lepidoptera. The outline of the wings is also frequently modified by the presence of these scent-organs.

Furthermore, both the organs themselves, and the sexual differences resulting from them are by no means restricted to the wings. In many species, especially among the Heterocera, they are placed in the abdomen; while in some others they are developed on the legs. Inasmuch as the abdominal organs are, in the state of repose, almost always withdrawn either into the interior of, or among the scales of, the abdomen, they have entirely escaped the attention of entomologists. In fact, the only notice I have come across refers to the genus *Lycorea*, the males of which, as Doubleday states,[1] "have a large tuft of hair on each side of the last segment, capable of being withdrawn to a great extent into the interior of the abdomen." Like the Lycoreas and Itunas, the males also of *Danais*, *Morpho*, *Glaucopidae*,[2] *Cryptolechia*, and various other nocturnal Lepidoptera, possess scent-organs situated at the extremity of the abdomen, sometimes taking the form of tufts, sometimes of mammiliform or digitiform protuberances, or filiform tubes of considerable length, and exhaling in nearly all cases a strong scent. It is rarest for these organs to be placed on the dorsum, as in *Didonis biblis*, or ventrally, as occurs in the *Sphingidae*. While in many cases these scent-organs were well known, but their functions undiscovered, it is different with the *Sphingidae*. In this group it has been known, for some years, that the males of certain species exhale a strong scent of musk, but no one has been able to find the spot from whence the scent emanates. It emanates from two tufts situated at the base of the abdomen, which are capable of retraction into a kind of groove formed by the scales of the first two segments.

Finally, as to the tufts and analogous appendages which occur on the legs of certain Lepidoptera, but in the males only, no one has, so far as I know, up till now, discovered any function for them to fulfil. In diurnal Lepidoptera such organs seemed to be confined to the *Hesperidae*, among which two different forms of them are to be found. According to Westwood,[3] the male of one species from Java, *Ismene oedipodea*, Swains, has the tibiae of the third pair of legs of extraordinary size, and covered with dense hairs: in various other species of the family, these same tibiae are, in the male, furnished with a long tuft of hair. These tibial tufts have been utilized by Herrich-Schaeffer and other authors to characterize certain genera of the *Hesperidae*, as *Achlyodes*, *Antigonus*, etc. When one sees in a Hesperid, shown, by the characters indicated by Herrich-Schaeffer, to belong to the genus *Antigonus*, that the tibial tufts can be retracted

[1] Doubleday, Westwood and Hewitson, *Genera of Diurnal Lepidoptera*, p. 196. Bundles of hair, like those mentioned in the text, are shown in the figure of *Ituna phenarete* (Pl. XVI., Fig. I). I have also seen them in the males of *Ituna ilione*.—F.M.

[2] See note 2 on p. 613.—E.B.P.

[3] Doubleday, Westwood and Hewitson, *loc. cit.*, p. 574.—F.M.

into a kind of groove formed by the scales of the abdomen, one cannot doubt that the tufts in question are scent-organs, seeing that they possess one of the most essential characteristics of these organs, viz. the special protection which, during respose, guards against the dissipation of the scent. I have, in fact, had the satisfaction of finding a moth whose tibiae emitted a peculiar perfume, which, without being strong, was yet perfectly perceptible even to us, with an olfactory sense far inferior to that of most Lepidoptera. It was one of the larger species of the family of the *Erebidae*,[1] having a wing expanse of 0·19 metre a species no one could overlook. In the females of this Erebid, the tibiae of the third pair of legs are slender in form, and, as is usual with the Lepidoptera, intermediate in thickness between the femora and tarsi (Pl. C, Fig. 10). In the males, on the contrary, these tibiae are extremely thick (Pl. C, Figs. 11 and 12), so that their breadth (4 mm.) equals one-third of the length (12 mm.). The outer surface is slightly convex, and on the inner there is a longitudinal groove beginning about 3 or 4 mm. from the base, and becoming deeper towards the apex of the tibia, as is best seen in transverse sections (Fig. 14). The entire inner surface, except the extreme tarsal apex and part of the groove, is covered with hairs of 4–6 mm. in length, but shortest along the upper margin (Fig. 13). These hairs are capable of being erected, forming a kind of very dense brush, and it is in the state of erection that their scent can be perceived.

In the state of repose, the median hairs lie in the longitudinal furrow parallel with the axis of the tibia, and are covered by a thick layer of the lateral tibial hairs ; these again are covered by the dense hairs on the lower edge of the femur, which also are far more developed in the male sex. In this manner the lower hairs, and especially those lying in the tibial groove, are sufficiently protected by the superimposed marginal hairs and those of the femur, against loss by evaporation of any odoriferous substance with which they may be impregnated while in a state of repose, whereas, on being erected, they exhibit an enormous surface which promotes a corresponding evaporation of the scent. It may be noted that even Linnaeus gave to one of the species of *Erebidae* the name of *Noctua odora*, probably in consequence of its strong scent; but whether this was peculiar to the males or produced by the tibiae he does not say. There are in the same family other species, whose males have the tibiae of ordinary form, without the excessive hairiness of the one above-mentioned, but furnished instead with a long tuft of hair issuing from the inner side of the base. Finally, still other species of *Erebidae* appear to be destitute of any scent-organs on the legs. Certain genera of the *Hesperidae* are also characterized by the tufts borne by the males on their posterior tibiae, while the males of the moth genus *Herminia* (included by some entomologists in the *Pyralidae*, by others, *e.g.* Speyer, in the *Noctuinae*) are usually furnished with larger or smaller tufts on their

[1] *Erebus* and its allies are *Noctuidae* of the sub-family *Noctuinae*.—E.B.P.

tibiae, but in this case it is the front tibiae which present this male distinctive character.[1]

In the family of the *Geometridae*, a beautiful and instructive instance of these scent-tufts, borne by the posterior legs, is yielded by *Pantherodes pardalaria*, Hübn., an insect which seems to inhabit the whole of Brazil, from the Equator to the Tropic of Capricorn. Spix and Martius took it on the Rio Negro,[2] also, at least in certain years, very frequently in the Province of Santa Catharina. This species also has the tibiae of the third pair of legs much larger in the males (Pl. C, Figs. 2 and 4), than in the females (Fig. 1), but they do not attain extraordinary dimensions. The inner surface is grooved by a longitudinal furrow (Fig. 3 *b*) in which is hidden a tuft of long and fine hair, springing from the base of the tibia (Fig. 3 *a*). The diameter of these hairs is from 0·004 to 0·01 mm., and their length equal to that of the tibia itself. The colour of the tuft varies in different individuals; some of the hairs are a bright bay, others varying from dark grey to nearly black, sometimes one colour, sometimes the other predominating. Along the margins of the groove are scales (Pl. C, Fig. 9), distinguished from those which cover the rest of the tibia (Fig. 8), by their much greater size, as well as by their shape and colour. Some of them at times reach a length of nearly 0·001 mm., and rarely a third as long again: some are asymmetrical, with the shape of the crescent moon, others symmetrical, with parallel sides and three or sometimes two teeth at the apex. Finally, these larger scales on the margins of the groove are pale straw-coloured; the smaller ones on the rest of the tibia being of a lighter or darker grey. Bending over the edge of the groove, these large scales form a kind of tent (Pl. C, Fig. 6 *c* and *d*), those on the lower margin being partly covered by those on the upper. There is thus produced by different means, but with equal efficiency, a covering which prevents the loss of any aroma which the tuft may contain. When the tibia is extended, the tuft begins to rise from its concealment, and erect itself, spreading out its hairs on all sides, but without exhaling any scent perceptible to the human nose, or at least not to mine.

Without doubt in the vast group of the moths, of which up to the present only a quite insignificant number has been examined, there must exist numerous other cases in which a scent apparatus is borne by the egs, the wings and other parts of the body. The object of these lines is simply to assist towards the complete elucidation of the subject with which they deal, and to point out to the young naturalists of Brazil a vast field, as yet unexplored, and promising a harvest of new and interesting facts.

[1] "Tibia enlarged and furnished with a tuft of erectile hairs." Chenu, *Encyclop. d'Hist. Nat., Papillons*, II., p. 215.—F.M. [Sir George Hampson informs me that *Herminia* belongs to the *Noctuidae*, sub-family *Hypeninae*.—E.B.P.]

[2] Perty, *Delectus Animalium Articulatorum*, 1830, p. 163; Pl. XXXII., Fig. 11. Perty here calls it *Phalaena perspicillum*.—F.M.

EXPLANATION OF PLATE C.

Figs. 1–9 refer to *Pantherodes pardalaria*.

Figs. 1–4 are magnified 3 times.

Fig. 1.—Left hind leg of female.

Fig. 2.—Left hind leg of male.

Fig. 3.—The same as Fig. 2, cut across the middle of the tibia.

a, upper part with the tuft which springs from the base of the tibia. View of the outer side.

b, lower part with the groove in which the tuft lies. View of the inner side.

Fig. 4.—The same leg with the tuft expanded, seen from outside.

Figs. 5 and 6 are magnified 15 times.

Fig. 5.—Transverse section of the female tibia.

Fig. 6.—Transverse sections of the male tibia, taken at the positions indicated in Fig. 2. + indicates the upper edge; = the external surface.

Figs. 7–9 are magnified 90 times.

Fig. 7.—Scales from the upper surface of the fore-wings.

a, upper scale.

b, lower scale.

Fig. 8.—Scales from the outer surface of the tibia.

Fig. 9.—Scales from the edge of the groove on the inner surface of the tibia.

Figs. 10–14 refer to an Erebid having a wing expanse of 19 cm.

Figs. 10–13 are twice the natural size.

Fig. 10.—Left hind leg of female.

Fig. 11.—Left hind leg of male, view of outer edge.

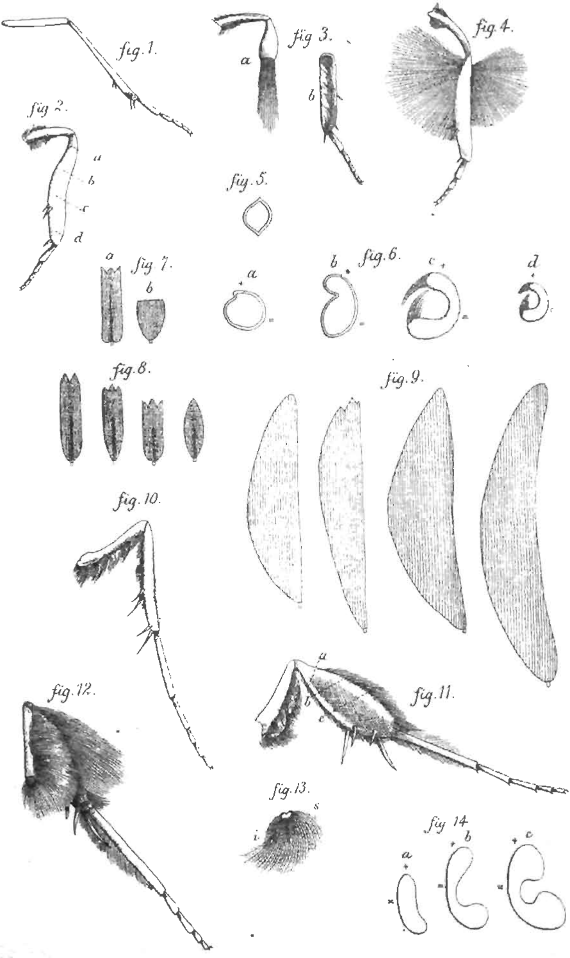
Fig. 12.—Right hind leg of male, view of the inner edge.

Fig. 13.—Junction of tibia and femur, seen from above, with the hairs erected.

s, hairs on the upper edge of the tibia.

i, hairs on the lower edge of the tibia.

Fig. 14.—Magnified four times. Transverse sections of the male tibia taken as indicated by the dotted lines in Fig. 11. + indicates the upper edge; = the outer surface.



Fritz Müller del. West, Newman photo-lith.

SCENT ORGANS ON THE LEGS OF MALE MOTHS.

§ V. *On Scent-organs on the Legs of certain Lepidoptera (Supplement).*[1]

PLATE D.

I CONCLUDED my notice on the odoriferous organs which distinguish certain male butterflies, by saying that the subject promised a harvest of new and interesting facts. It appears to me to be, in fact, an inexhaustible mine. Scarcely a fortnight has passed and I am able to add to the structures described in that paper two others—and these the most singular I have encountered among our Lepidoptera—found in the males of two species of Erebid moths.

One of them is a dwarf in this family of giants, whose expanse, with open wings, does not exceed 4 centimetres. In some species of the same family, as in various *Hesperidae* (*Achlyodes*, *Antigonus*, etc.), the scent-organs consist of a tuft of long hairs rising from the base of the hind tibiae. The organ in these species of Erebids presents a similar form, but arises from the base of the anterior and not of the posterior tibiae. The tuft is composed of black hairs, whose length (4 mm.) exceeds that of the tibiae (2 mm.), as also of the femora (3 mm.). Just as in some *Hesperidae*, the scent-tuft of the hind legs is hidden between the hind coxae and the base of the abdomen, so in the Erebids in question it is appressed lengthways along the under side of the femur, whose margins are bordered with pale hairs, forming a sort of case for the tuft (Pl. D, Fig. 1). The front tibia can not only be extended so as to form a straight line with the femur, as is observed in other Lepidoptera, but can go even beyond this (Fig. 2); and it is by means of this excessive extension, that the scent-tuft is unsheathed or drawn out of its case, being at the same time erected. In the second species, whose expanded wings measure about 6 centimetres, the scent-organs occupy the femur of the second or middle pair of legs.

These organs are most interesting, not so much on account of their unusual position as for their size, and for their verily monstrous proportions, forming as they do a kind of ball, a globose or ellipsoidal body, whose diameter equals the length of the femur (Pl. D, Figs. 5, 6, 7). Neither in the front nor in the hind legs (Fig. 3) is there any difference between the two sexes of the species: the intermediate legs of the male, on the contrary, not only exhibit the profound modification of the femur, due to the development of the scent-organs, but are also distinguished from those of the female (Fig. 4) by the greater length of the first tarsal joint. The

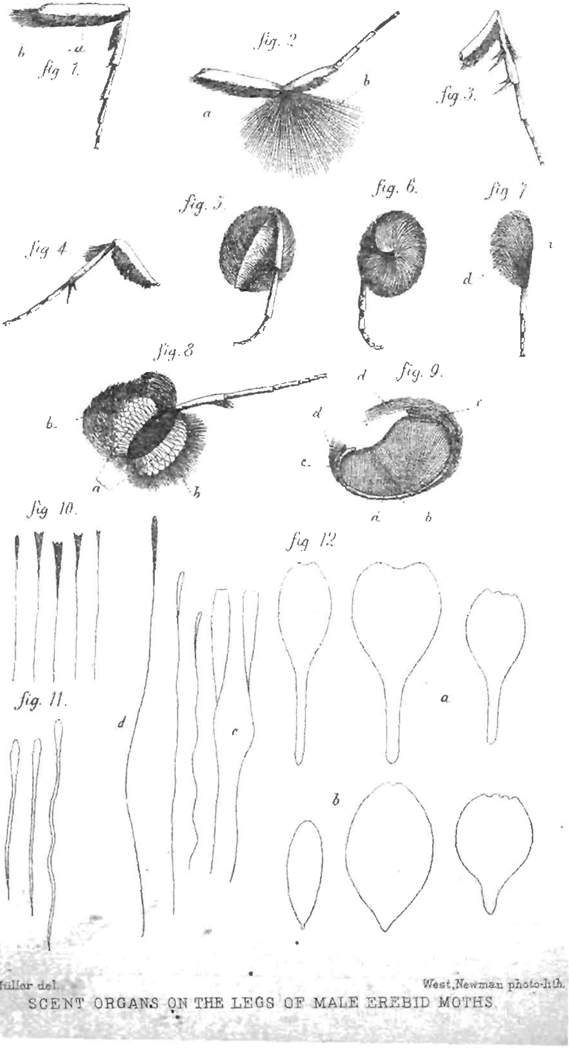
[1] *Archivos do Museu Nacional do Rio de Janeiro*, II. (1877), pp. 43–46. By Dr. Fritz Müller, Travelling Naturalist for the National Museum.

femur is about 6 mm. long in the female, 7 mm. in the male, the tibiae 5 mm. in both sexes, the first tarsal joint 3 mm. in the female, 4½ mm. in the male, the other tarsal joints 4½ mm. in both sexes. The mobility of the femur, evidently hindered by the scent-organ, may in some measure be compensated by the increased length of the first tarsal joint.

The femur of the male (Pl. D, Fig. 5), with a breadth of 2½ mm., slightly more than one-third of its length (7 mm.), is at the same time greatly flattened, so that the dorsal and ventral surfaces approach closely and almost touch. The ventral surface is slightly convex, the dorsal concave. The scent-organ, which occupies the concave surface of the femur, is composed of an interior, strongly odoriferous, and an exterior protective part. The former is made up of innumerable very large scent-scales (Pl. D, Figs. 9 *b* and 11), entirely covering the dorsal surface of the femur: they have the form of a narrow ribbon about 0·03 mm. wide and 2–3 mm. long, but longer still on the anterior or superior margin of the femur. The apex of each scale is expanded into a larger or smaller oval club (about 0·06 mm. wide and 0·25 mm. long).

Many of the scent-scales adhere together in consequence of this terminal enlargement, and the surface of the compact mass thus formed is necessarily larger than its base, that is, than the area of the femur from which it springs (Pl. D, Fig. 9). When detached from the femur, the scent-scales have an appearance like that of some kinds of cotton removed from the capsule, forming a fluffy mass of incredible size: it seems impossible, indeed, that such a volume could have been contained in so limited a space. The scent-scales are everywhere protected and covered by an edging of large scales and hairs, inserted all round them on the margins of the femur. The innermost scales of this border, which lie immediately upon the scent-scales (Pl. D, Fig. 12 *b*) are ovate, usually about 1·5–2 mm. in length by 0·6–1·2 broad. The scales outside those just described have their base prolonged into a sort of petiole (Fig. 12 *a*), outside these again the petiole becomes thinner and thinner, the club, at the same time, narrower and narrower (Fig. 12 *c*), until finally the scales are insensibly transformed into hairs (Fig. 12 *d*), which betray their origin solely by a slight enlargement of the apex. These hairs, forming the outer layer of the covering of the scent-scales (Fig. 9 *d*), are longest on the anterior or superior margin of the femur, and especially long at the base of that margin, where they exceed the length of the femur itself.

There are thus in the family of the *Erebidae* some species whose males are provided with scent-organs on the tibiae of the hind legs; others possessing these organs on the tibiae of the front legs, others on the femora of the middle legs, and finally others whose legs show no trace of any apparatus which could serve as a scent-organ. From this we may conclude that the organs in question were not inherited from a common ancestor, but acquired later by the various species which now enjoy these attractive sexual possessions.



Fritz Müller del. West, Newman photo-lith.

SCENT ORGANS ON THE LEGS OF MALE EREBID MOTHS.

EXPLANATION OF PLATE D.

Fig. 1.—Magnified 5 times. Front leg of the male of a small species of Erebid. *a*, pale hairs fringing the edge of femur; *b*, tuft of hair springing from the base of the tibia, hidden between the hairs of the femur.

Fig. 2.—The same leg with the scent-tuft erected.

Figs. 3–8 are twice the natural size.

Figs. 3–12 refer to a different species of Erebid.

Fig. 3.—Right hind leg of male.

Fig. 4.—Left intermediate leg of female.

Fig. 5.—Left intermediate leg of male, seen from the ventral side.

Fig. 6.—The same from the dorsal side.

Fig. 7.—The same, seen from the anterior or upper margin of the femur. *d*, dorsal side; *v*, ventral side.

Fig. 8.—Right intermediate leg of male, seen from the dorsal side, after removal of the scent-scales. *a*, scales; *b*, hairs on the edge of the femur, protecting the scent-scales.

Fig. 9.—Magnified 5 times. Transverse section of the scent-organ. *a*, femur; *b*, scent scales; *c*, protecting scales; *d*, hairs.

Figs. 10–12 are magnified 15 times.

Fig. 10.—Dart-like scales from the intermediate femur of female.

Fig. 11.—Scent-scales covering the dorsal side of the intermediate femur of male.

Fig. 12.—*a*, petiolate scales; *b*, the inner ovate scales [1]; *c*, hair-like scales; *d*, hairs of the fringe which protects the scent-scales.

[1] In the original, the descriptions of *a* and *b* in Fig. 12 were accidentally transposed, *a* being described as ovate; *b* as petiolate.—E.A.E.

§ VI. *On the Scent-organs of* Antirrhaea archaea, *Hübn.*[1]

PLATE E.

THE sexual difference in [the Satyrine butterfly] *Antirrhaea archaea*,[2] produced by the scent-organs of the males, has been mentioned by various authors. Thus Westwood (*Gen. Diurn. Lepidopt.*, 1851, p. 365), makes *Antirrhaea* the third section of the genus *Haetera*, and distinguishes it by the [fore]-wings of the male being dilated on the inner margin and furnished with a mane-like hairy tuft beneath. Butler (*Cat. Satyrid. Brit. Mus.*, 1868, p. 106), taking *Antirrhaea archaea* as the type of a new genus, *Anchiphlebia*, mentions among the distinctive characters of this genus not only the convex inner margin and the "plaga pectinatim cirrosa [cirrata]" of the fore-wings, but also a very noticeable difference between the two sexes in the neuration of the hind-wings:—"alae venis posticarum prima et secunda subcostalibus ad origines mari valde approximatis et subparallelis." Butler, at the same time, illustrates the characters in question by a figure (*l. c.*, Pl. V. 3).

Now tufts of hair, beards or manes, are in general the chief part of the scent-organs of male Lepidoptera: in most cases also, these organs are accompanied by more or less profound modifications of the nervures of the wings. It seems therefore very strange that the males of *Antirrhaea archaea* should have a mane on the fore-wings, and modified veins in the hind ones, since, according to existing descriptions and figures, these hind-wings show no indication of any scent-organs. In consequence of this anomaly, real or apparent, I examined with the keenest interest several individuals of both sexes of this somewhat rare butterfly, which I met with for the first time in the Province of Santa Catharina in January of the present year.

As soon as I took hold of them, I was convinced that the males, and these only, were endowed with a most distinct scent, emitted from the very elegant mane on the fore-wings. Nor was I long in recognizing that the anomaly is only apparent, for a scent-organ of a most peculiar kind extends along the modified nervures of the hind-wings, and, comparing my specimens with Butler's plate, it required little to convince me that

[1] *Archivos do Museu Nacional do Rio de Janeiro*, III. (1878), pp. 1-7. By Dr. Fritz Müller, Travelling Naturalist for the National Museum.

[2] *Antirrhaea archaea*, female, is figured by Dr. Chenu, *Encyclop. d'Hist. Nat., Papillons*, I., p. 299, Fig. 514.—F.M.

he has incorrectly drawn the mane of the fore-wings, giving to the hairs a wrong direction.

I consider, therefore, in view of the errors and omissions in the existing descriptions and drawings of the scent-organs of *Antirrhaea archaea*, that it is desirable to figure and describe them afresh.

The inner margin of the fore-wing forms in the female (Pl. E, Fig. 1), a nearly straight line from the base of the wing to the end of the internal [submedian] nervure: in the males, on the contrary (Fig. 2), the inner margin forms, between these points, an almost regnlar arc of 120 degrees of a circle whose centre lies at the apex of the angle formed by the median nervure and its first branch. Furthermore, the internal [submedian] nervure, after making an obtuse angle[1] near the base, is straight in the females, curved like an S in the males. Thus in this sex the area included between the internal [submedian] nervure, the median and its first branch is larger in the ratio of 4 to 3, and the greater part of this area is occupied, on the under surface of the wing, by the characteristic mane of pale hairs. This mane commences at a short distance from the base of the wing, the line of insertion following for a little more than two-thirds of its length, the internal [snbmedian] nervure, from which it is separated by an interval about equal to the diameter of the nervure itself. Beyond this point the mane, gradnally diminishing the radius of its curve, turns forward (that is, towards the dorsal [costal] edge of the wing) terminating at a little distance from the first branch of the median. Towards the base of the wing the hairs of the mane (Pl. E, Fig. 5) are straight, and about 3 mm. long; in the middle 12–16 mm.; towards the apex abont 8 mm., and blunt at their free extremities. At the spot where the mane turns away from the internal nervure the hairs are thicker, being about 6 mm. long, and bent into a slight curve with its convexity towards the base and inner margin of the wing.

The hairs are not disposed in a single row, but, as may be best seen by their points of insertion, in 3, 4, or 5 layers, the number rising to 10 or more in the first two millimetres nearest the base of the wing. When the mane is removed, that part of the wing which lay beneath does not show any perceptible difference from the surrounding parts, yet microscopic examination reveals a profound distinction in the arrangement and form of the scales.

The ordinary scales of the parts surrounding the organ (Pl. E, Fig. 10) are disposed in regular rows, made up of lower, or succubi, alternating with upper, or incubi. The distance between the rows is about 0·08 mm., that between the scales in the row about 0·03 mm. The upper scales, or incubi (Fig. 10 *a*) are longer (0·2), narrower (0·03), and at the same time darker; the lower, or succubi (Fig. 10 *b*) shorter (0·13), broader (0·05), and paler; but their apices are either rounded, like those of the incubi, or dentate.

[1] "Obtuse angle" is obscure. The submedian makes an acute angle with the median in both sexes.—E.B.P.

The scales under the mane are not disposed in regular lines, nor are they divided into succubi and incubi: they are much fewer than the ordinary scales, and do not entirely cover the wing. Near the base of the wing (Pl. E, Fig. 11) they are far smaller than the others, having about the length, more or less, of the ordinary succubi with the breadth of the incubi. Towards the outer margin of the wing they gradually increase in size, so that at last (Fig. 12) they can scarcely be distinguished from the ordinary succubi with rounded apex. In colour and texture the scales of the organ resemble the ordinary succubi, showing, like these, the very distinct longitudinal striation which is usually not to be seen in scent-scales. All other distinctive characters of the scent-scales are wanting. Another singular and notable distinction between the area covered by the mane and the surrounding parts is found in the direction of the scales. They are, as a general rule, turned with apices pointing towards the outer margin of the wing (that is towards the right in Pl. E, Fig. 5); but those below the mane follow more or less exactly the direction of the hairs which cover them (thus, in Fig. 5 the scales at the base are directed towards the top, those of the terminal part towards the left), so that at a certain point scales which are very close together and only separated by the insertion of the hairs yet point in entirely different directions.[1]

When the scales of the fore-wings are removed, we see, in the space covered by the mane, a very opaque spot, elliptic in shape, measuring seven by three mm. If we draw a straight line from the vertex of the angle formed by the median nervure and its first branch to the point where the mane turns away from the internal [submedian] nervure, this line coincides with the major axis of the ellipse. The opacity of the spot, otherwise hardly noticeable, is due to innumerable small dark-bordered points or circular pits of scarcely 0·002 mm. diameter, which are here scattered on the wing membrane.

As with the inner or posterior margin of the fore-wing, so also with the anterior [costal] margin of the hind-wing, which is almost straight in the female (Pl. E, Fig. 3) and distinctly arched in the male (Fig. 4). The upper surface of these wings is of a fawn colour, and on it we see, in the males, two spots which are distinguished by their brilliancy and their colour. The larger (Fig. 4 *m′*; Figs. 7, 8, 9) surrounds the angles formed by the upper discocellular nervure and by two branches (6, 7, in Figs. 6–8) of the subcostal, and is prolonged between these two branches as far as they run approximately parallel. The irregular quadrilateral base of the spot is dull ash-colour, its prolongation whitish, and thus more visible. The lower spot (Fig. 4 *m″*) occupies the angle between the two internal nervures [submedian and internal]. Both spots are thickly covered with scales, which, in their complete opacity and want of the longitudinal striation,

[1] The hairs of the mane start from a strongly curved base line, and are directed towards a common centre. Hence those in the middle of the curve point in opposite directions, as do the scales between which they arise.—E.A.E.

resemble the scent-scales of many other Lepidoptera. The shape of the scales on the smaller spot (Pl. E, Fig. 15) do not differ greatly from the ordinary incubi (Fig. 13 A) of the adjoining parts of the wing; those of the larger spot (Fig. 16) are, on the contrary, so narrow as to be almost mistaken for hairs. The latter are 0·16 mm. in length; those of the smaller spot 0·13 mm., by 0·025 to 0·03 broad.

After removing the scales, the spots become much more conspicuous than before, differing not only by the amount of their opacity, but also by their horn-like colour, rather pale in the smaller spot, but darker at the base and still somewhat dark in the prolongation of the larger. The smaller spot contains the ramifications of a few slender air-vessels, springing from the two [internal] nervures bounding the spot. In the larger spot these air-vessels attain a much greater, and sometimes a truly enormous, development, although different individuals vary greatly in this respect. The majority of the air-vessels which run through this spot are more or less dilated at their bases, and tortuous, resembling varicose veins (Pl. E, Fig. 8). In some individuals the dilatation of the air-vessels extends so far that they occupy nearly the whole area of the scent-spot, losing at the same time their capillary ramifications (Fig. 9). In Fig. 7 this same degree of varicosity is exhibited by the air-vessels between the two branches (6 and 7) of the subcostal nervure, and to the left of the upper discocellular, whereas on the right of the latter nervure there are various forms transitional between the ordinary air-vessels and those which are excessively dilated and destitute of capillary branches.

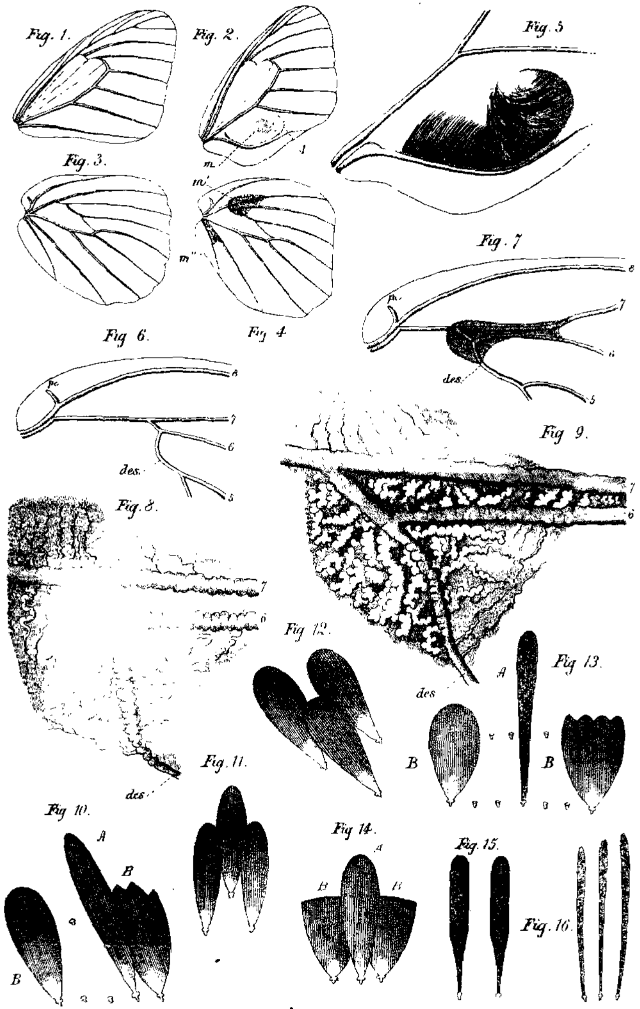
The variability of the air-vessels also extends, though in a much less degree, to the nervures which traverse the spots and from which these air-vessels arise. The two branches of the subcostal nervure (6 and 7) may be either nearly parallel (Pl. E, Figs. 4 and 8), or convergent (Figs. 7 and 9), sometimes almost meeting. In the females on the other hand (Figs. 3 and 6) these branches diverge from their point of origin. The upper discocellular nervure traverses the spot either in a straight line (Fig. 8) or in a slight curve (Fig. 9).

This extraordinary variability of the air-vessels of the scent-patches affords an excellent example of a law admirably discussed by Darwin (*Origin of Species*, 4th Ed. p. 177) that "a part developed in any species in an extraordinary degree or manner in comparison with the same part in allied species, tends to be highly variable." Although the scent-patch with its greatly modified veins and air-vessels is not confined exclusively to *Antirrhaea archaea*, it appears to be restricted to the three allied species united by Butler in the genus *Anchiphlebia.*

Another notable point is the separation of the scent-organ into two parts, for it appears that to the hind-wings is reserved the production, to the fore-wings the emission and exhalation of the scent which is intended to attract the amorous females. As to the dark spot on the anterior wings, it seems to be a rudimentary scent-organ, which, though it is as

yet uncertain whether it is in a state of evolution or retrogression, must eventually either be perfected or disappear.

Comparing the scent-organs of *Antirrhaea archaea* with those of *Epicalia acontius*, which I have previously described, we find an almost complete agreement between their compouent parts. In both species those margins of the wing which overlap each other, are considerably dilated and arched in the male sex : in both the under side of the npper wing is furnished with a mane of long hair inserted along the internal [submedian] nervure, and covering a scent-patch, well developed in the *Epicalia*, rudimentary in *Antirrhaea.* Opposite the mane, there is in both species on the upper surface of the lower wing, a scent-patch, whose central part occupies the angle between the two branches of the subcostal nervure, extending from thence into the three adjoining areas of the wing. Now all this would be very simple, and would be easily explained if the two species belonged to the same, or to allied genera, for then all the characters in which their scent-organs correspond might have been derived from a common ancestor. So far from this being the case, however, they are of two very different sub-families, *Antirrhaea* being claimed by the *Satyridae* and *Epicalia* by the *Nymphalidae*, while even the nearest relatives of both are destitute of similar organs. They are completely wanting, for instance, in *Epicalia numilia.* Hence, there can be no doubt that the scent-organs have been independently developed in these two species, and that everything they have in common is solely due to the circumstance that they are adapted to fulfil the same function. The two organs are not "homologous," but simply "analogous," and they furnish a most notable example of "convergence," to use the modern term for a resemblance caused, not by inheritance, but by adaptation to similar circumstances. I know of no other case which proves so clearly and irrefragibly, and attests with such force, the truth of a principle which should never be lost sight of in morphological studies, viz.—when in two species certain organs which serve the same function, are found in the same place, are composed of the same parts occupying the same relative positions, and exhibiting similar forms—all this by itself constitutes no sufficient proof that these organs are homologous, nor does it give ground for placing the two species in the same family.



Fritz Müller del. West, Newman photo-lith.

SCENT ORGAN OF THE MALE SATYRINE BUTTERFLY ANTIRRHAEA ARCHAEA.

EXPLANATION OF PLATE E.

All the figures refer to *Antirrhaea archaea*, Hübn. Figs. 1–4 are of natural size; 5, 6, and 7 magnified 8 times; 8 and 9 magnified 15 times, and the remainder 180 times.

Fig. 1.—Fore-wing of female, after removal of scales. Note in this figure and the next, the well-developed nervures, and, in addition, distinct traces, in the cell, of the discoidal nervure divided into two branches, and of the posterior branch of the subcostal.

Fig. 2.—Fore-wing of male. *l*, line of insertion of the mane, dilated at base; *m*, opaque patch.

Fig. 3.—Hind-wing of female.

Fig. 4.—Hind-wing of male. *m'*, larger scent-patch, covered by the mane of the fore-wing; *m''*, smaller patch, concealed between the wing and the abdomen.

Fig. 5.—Mane on the under surface of the fore-wing of male. In Butler's figure (*Catal. Satyrid. Br. M.*, Pl. V., Fig. 3), the hairs appear to be attached by their anterior extremities and to point downwards. Can this be a specific difference? It is more probably an error.

Figs. 6 and 7.—*Part of hind-wings, showing the difference* between the nervures of the female (Fig. 6), and the male (Fig. 7). 5, discoidal nervure; 6, the second, and 7, the first branch of the subcostal; 8, the costal nervure; *dcs*, upper disco-cellular nervure; *pc*, precostal nervure.

Figs. 8 and 9.—Larger scent-patch of male, after removal of scales; taken from two different individuals to show the great variability of the air-vessels. To simplify the figure, the points of insertion of the scales have been omitted.

Fig. 10.—Ordinary scales from the lower surface of the fore-wings. A, incubi; B, succubi.[1]

Figs. 11 and 12.—Scales from the area covered by the mane.

Figs. 13 and 14.—Ordinary scales from the upper surface of the hind-wings;—those in Fig. 13, from the angle between the two internal nervures; those in Fig. 14, from the space between the discoidal and the second branch of the subcostal. A, incubi; B, succubi.

Fig. 15.—Scale from the smaller scent-patch.

Fig. 16.—Scales from the larger scent-patch.

[1] The reference letter B is omitted from Fig. 10 in the original plate, and both A and B from Fig. 14.—E.A.E.

§ VII. *On the Costal Fold of the* Hesperidae.[1]

PLATES F AND G.

WHEN writing of the sexual differences of the *Hesperidae*, Westwood[2] says that "in some groups the fore margin of the fore-wings is recurved in the males, the enclosed space being thickly clothed with pale-coloured down." Herrich-Schaeffer gave to this recurved margin of the fore-wings the name of "costal fold," making use of it as a distinctive character of the genera in which it occurs.[3]

I was convinced that until the costal fold of all species known to possess it had been submitted to a microscopic examination and compared with one another, it would be impossible to form an opinion as to its function; also that, from a purely systematic point of view, this structure, being at once varied and diverse in very similar species, was well deserving of close study.

Of the many hundreds of *Hesperidae* furnished with a costal fold, I have only been able to secure less than a dozen—too few to permit me to draw any general conclusions from my observations: I publish them more for the purpose of arresting the attention of entomologists than for their own value.

In the *Hesperidae*, as in many nocturnal Lepidoptera, the anterior margin of the fore-wings is occupied by a nervure unnamed by Lepidopterists, which, as I shall frequently mention it, I call the marginal nervure (M in Figs. 2, 7, 13, 20, 24, 26, Plates F, G).

The species in which I have examined the costal fold are the following:[4]

Telegonus midas, Cram. (Pl. F, Figs. 1–5).—If the costal margin of the fore-wings be divided into five equal parts, the costal fold occupies the second and third, counting from the base, and is about 15 mm. long by 1·5 mm. broad. The fold extends along the margin of the wing, and resembles a figure bounded by two arcs of a circle and divided into two parts by their common chord (Figs. 1, 2). These two parts are composed of the reflexed margin of the wing, bounded by the marginal nervure, and that part of the wing which it covers. Both the arcs bounding this figure

[1] *Archivos do Museu Nacional do Rio de Janeiro*, III. (1878), pp. 41–50. By Dr. Fritz Müller, Travelling Naturalist for the National Museum.

[2] Doubleday, Westwood, *Gen. of Diurnal Lepidopt.*, 1852, p. 506.—F.M.

[3] Herrich-Schaeffer, *Prodrom. Syst. Lepidopt.*, fasc. iii., 1869, p. 52.—F.M.

[4] I follow the nomenclature of Kirby's *Cat. Diurnal Lepidopt.*, 1871.—F.M.

are bordered with lustrous, straw-coloured scales. A third fringe of scales of the same colour, but thinner and longer, is inserted along the common chord, entirely covering the folded part of the wing. The length of the scales of this third fringe equals or slightly exceeds the width of the fold; they are longest in the middle of the chord (1·5–2 mm.) where they are furthest from the arc; they all have a long, narrow blade, which in some is gradually widened, fan-like, into a narrow triangle, with its apex more or less dentate (Fig. 3 *a*); others (Fig. 3 *b*) are filiform, terminating in an oval lamina, or in a narrow, apically rounded ribband. The scales which bound the area covered by the fold (Fig. 4) are of very varied shape, but mostly oval or claviform: nearly all have a dark terminal spot, full of opaque granules, separated from the rest of the scale by a transparent aureola. These dark spots are sometimes very small, reduced to a mere dot, but sometimes occupy the whole width of the scale: they are not always exactly terminal, being sometimes displaced to one side: rarely two spots are to be seen on the same scale. The aureola which surrounds the spots is usually circular, but is sometimes less regular in shape.

The longitudinal striae which cover the scales pass over the aureola also, but become confused and indistinct on the dark spots. The opacity and granulation of the dark spots are characters frequently met with in scent-scales, and since the apices of the scales with dark spots are covered by the free margin of the fold, it appears not improbable that they are odoriferous. Thus these scales may discharge at the same time two very different functions, the basal part serving to close the fold, the apical acting as a scent-organ.

On removing the scales from the straight line which, cutting longitudinally through the fold, separates the recurved part from the rest of the wing, it is seen that the space between these scales and the folded part of wing is covered with a dark grey powder, composed chiefly of separate particles (Fig. 5 *a*), measuring about 0·016–0·025 mm. long by 0·004 mm. broad; their sides, generally parallel—more rarely converging towards one end—are transparent, yellowish, and usually traversed by a more or less dark and opaque longitudinal line. Between these particles are others (*Fig. 5 b*), joined end to end by very fine, short threads, like more or less distinctly jointed hairs (Figs. 5 *c*, *d*).

The origin of the powder which fills the cavity of the costal fold is revealed by these articulated hairs, for it is composed of their fragments. Finally, to complete the description of the scales found in the costal fold of *Telegonus midas*, I may mention certain narrow scales, about 0·6 mm. long by 0·016 mm. broad, which I found in the cavity of the fold, without being able to ascertain exactly where they were inserted.

Telegonus (?), undetermined species from S. Bento (Pl. F, Figs. 6–9).—This species, of which I was only able to secure one specimen, much worn, but with the costal fold well preserved, is remarkable both for the extent of this fold, which occupies nearly three-fifths of the costal margin (*Fig. 6*),

and for the unusual size of the marginal nervure (Fig. 7, M), which is indeed much larger than the costal and subcostal nervures (Fig. 7 *c* and *sc*). The cavity formed by the costal fold is bounded and closed beneath by very numerous scales arising along the straight line which separates the folded margin from the rest of the wing, and above by the margin of the fold. A fringe of smaller scales is inserted along the marginal nervure.

The "pale-coloured down" in the interior of the costal fold arises from the upper surface[1] (lit. "wall"), both of the marginal nervure and of the folded margin of the wing (Fig. 7). It is composed entirely of articulated hairs, with joints, which are mostly separated (Fig. 8), varying greatly in size, averaging 0·04–0·06 mm. long by 0·008–0·01 mm. broad: those which are united in greater or less numbers are usually very much narrower (Fig. 9). The joints are transparent, but with some dark dots.

Telegonus mercatus, Fab. (Pl. F, Figs. 10, 11).—The costal fold (Fig. 10 P) is smaller than in the two preceding species, only extending over about one-third of the anterior margin of the wing; its breadth is rather more or less than half that of cell 12 (adopting Herrich-Schaeffer's term for the space between the costal nervure and the anterior [costal] margin of the wing). In the interior of the fold one finds a series of most curious scales (Fig. 11). Some, in the first place, represent the primitive form from which the others may be derived; they are long, stout scales (Fig. 11 *i*), about 0·3 mm. long, of which about one-sixth is taken up by the terminal triangular or oval lamina, the remainder by the stalk. Some are contracted below the terminal lamina, forming a sort of neck. In other similar but smaller scales (Fig. 11 *g*, *h*), the neck is very much narrower, and the terminal lamina does not exceed, or even equal, the lower part of the stalk in breadth. The metamorphosis of the scales continues in the same direction (Fig. 11 *e*, *f*) reaching at last a specialized form, in which the neck connecting the terminal lamina with the stalk, is reduced to a very fine thread (Fig. 11 *c*, *d*). Finally, there are scales, similar to the last-named, but ending in a fine, sometimes almost imperceptible thread, without any terminal lamina (Fig. 11 *a*, *b*).

It is certain that some of these scales were originally provided with a lamina, for I found loose several of these appendages, similar to the ones shown in Fig. 11 *c*, *d*. It seems to me, however, that some of the scales never possessed this structure, for the number of the separated laminae was not equal to that of the scales.

Hesperia syrichthus, Fab. (Pl. F, Fig. 12–18).—This species, which is not so prevalent in South America as in Central America and the southern parts of the United States, is very common in the province of Santa Catharina.

The costal fold is somewhat large, and occupies the basal half of the costal margin of the wing, extending to the costal nervure (Fig. 12).

[1] The whole of the interior of the fold is of course the upper surface of the wing.—E.B.P.

The marginal nervure (*Fig. 13 M*) is furnished with more or less curved scales of oval or orbicular shape (Fig. 14). The whole internal surface of the costal fold, from the costal to the marginal nervure, is clothed with scales or thick hairs of various forms.

Along the curved margin there are pale scales (Fig. 15), oval in shape, about 0·01–0·03 mm. in breadth, and with rounded apex. At the base of the angle formed by this margin and the rest of the wing, the scales are less pale, opaque, very narrow, tapering to a fine point (Fig. 18), and about 0·08 mm. long by 0·005 mm. broad. Finally, on that part of the wing which is covered by the folded margin there are scales of two very different shapes: the first (Fig. 17) are lanceolate, about 0·14–0·17 mm. long by 0·03–0·04 mm. broad; the second (Fig. 16) are far more slender, transparent, tubular, varying from 0·2 to 0·27 mm. in length, and from 0·002 to 0·006 mm. in breadth. Gradually diminishing in size, these latter scales are terminated by an extremely fine thread, bearing at its apex a very small lamina, shaped like an obtuse-angled isosceles triangle. The sides of this triangle are marked with very fine, almost imperceptible lines, which, at first sight, are only seen at the base as straight lines perpendicular to the extremity of the sustaining thread.[1] These singular scales of *Hesperia syrichthus* (Fig. 16), although apparently so different from those of *Telegonus mercatus*, may, nevertheless, be easily derived from the same form (Fig. 11 *i*).

Leucochitonea arsalte, Linn. (Pl. G, Figs. 19–22). The costal fold of the males is much smaller than in the last species, occupying scarcely one-third of the costal margin of the wing, and less than half the breadth of the space between the margin and the costal nervure.

The down enclosed in the fold arises only from the surface of the folded margin, and is protected by two lines or fringes of scales, one of which is inserted along the marginal nervure (Fig. 20 M), the other along the straight line which separates the folded portion from the rest of the wing: the latter scales are about as long as they are broad, but much shorter than those on the marginal nervure. The down is composed of scales of two different forms, similar to those in *Hesperia syrichthus*.

Those of the first form (Fig. 21) are like a spear head; the length is about 0·15 mm.; the breadth varies from one-ninth to one-fourth of the length, and is greatest at, or close to, the point of insertion, from whence a line runs almost straight to the sharp apex of the scale. These scales, which evidently correspond to those of *Hesperia syrichthus* in Pl. F, *Fig.* 17, are pale, transparent, the apex more or less opaque, the base having almost always a longitudinal stripe, composed of opaque granules. The scales of the second form (Fig. 22) corresponding with those in Pl. F, Fig. 16, are about the same length, 0·15 mm., but so slender as almost to deserve the name of hairs, being rarely as much as 0·002 mm. broad, and usually

[1] It is probable that the meaning of this difficult passage would be more clearly conveyed by substituting the words "radiating from" for "perpendicular to."—E.A.E., E.B.P.

much less; they terminate in a very fine thread, having at its apex a punctiform button, which is sometimes wanting.

Thymele simplicius, Stoll. = *eurycles*, Latr. (Pl. G, Figs. 23–28). Herrich-Schaeffer[1] distinguishes three varieties of *Eudamus* (*Gonuruis*) *eurycles*, as he calls the species designated *Thymele simplicius* in Kirby's Catalogue. The first variety, which I have not seen here, has no transparent points or spots on the wings, and three costal spots on the under side only. In the second variety the three costal spots are visible on both sides of the wing, and it has a row of transparent dots along the basal half of the anterior [costal] margin. The costal fold is always present in the males of this second variety, which I have several times met with here. In the third variety the transparent dots and spots form a narrow band, sometimes stopping short of the third cell [viz. the internervular space above the second branch of the median] (as in Fig. 25), sometimes extending beyond the second nervure or first branch of the median (as in Fig. 23). According to Herrich-Schaeffer, both the male individuals, whose fore-wings[2] are represented in Figs. 23 and 25, belong to this third variety, although in one (Figs. 23, 24) there is no trace of a fold, while in the other (Figs. 25, 26) it is well developed.

As this third variety is abundant on the Rio Itajahy, I have been able to examine a large number of individuals, and to confirm the fact that the fold is wanting from all the males in which the transparent band enters the first cell (Fig. 23), and is present in all whose band does not extend beyond the second nervure (Fig. 25). In the individuals furnished with a costal fold, the transparent spots differ greatly in number and size: there is an infinite number of forms intermediate between Herrich-Schaeffer's second variety and other similar males without the costal fold, but possessing, like the former, the transparent spots in cells 3 and 6 and barely distinguished by the absence of the transparent spot in cell 1. There is also considerable variation in the scales composing the down in the costal fold.

The scales represented in Fig. 27 belong to individuals with only three costal spots—*in cells 7 to 9*—and wanting the transparent spot in cell 3 (Fig. 25): those in Fig. 28 were taken from a male with four costal spots in cells 6 to 9, and a transparent spot in cell 3. The scales enclosed in the costal fold show two principal forms. The first (Fig. 27 *a*, *b*, *c*, *d*; Fig. 28 *a*, *b*) are distinguished by a lanceolate basal part, narrowing *gradually to a more* or less *filiform terminal* part, which is again expanded into a kind of lamina or triangular fan. The length of these scales in some males scarcely reaches 0·08 mm. to 0·16 mm. (Fig. 28), in others rising to 0·2 mm. to 0·3 mm. (Fig. 27). The scales of the second form are about the same length as the first, usually narrower (Fig. 27 *e*; Fig. 28 *d*), but sometimes perfectly capilliform (Fig. 28 *d*); they are drawn out very,

[1] *Prodrom. Syst. Lepidopt.*, fasc. iii. 1868, p 61.—F.M.

[2] The word used is "interiores."—E.A.E.

gradually into an extremely fine thread, at whose extremity a very small punctiform button may sometimes be found (Fig. 27 *e*). There are also usually other scales, shorter, broader, and opaque, resembling those of the first type (Fig. 27 *f*; Fig. 28 *c*). The costal fold occupies about the middle of the anterior margin of the wing, and is rather narrow.

If in all the districts inhabited by *Thymele simplicius* the males without the costal fold are chiefly distinguished, as they are here, by the prolongation of the transparent band beyond the second nervure, I consider that they should be ranked as a distinct species, and not as a mere variety. However this may be, it is worthy of notice that of two similar forms, included by Herrich-Schaeffer and others under a single variety, one has the costal fold well developed, while the other is entirely destitute of it.

It appears that this absence of the costal fold in some males of *Thymele simplicius* has not been previously noticed. Such males have probably been mistaken for females, just because of the want of these folds, a mistake pardonable in any one unable to examine the living insects, in which case the sexes are easily distinguished by the genitalia.

Thymele protillus, Herr.-Sch. (Pl. G, Fig. 30). The costal fold covers about half the anterior margin of the wing, and extends a little beyond the transparent spot in cell 12. There are in the interior of the fold :— 1. Scales of about 0·3 mm. long, with lanceolate base, terminated by a lamina which is either rounded, oval, triangular, or cordiform, and of variable breadth (Fig. 30 *a*); 2. Very fine hairs of the same length (Fig. 30 *b*); 3. Narrow scales (Fig. 30 *c*) almost parallel sided, about 0·12 mm. long and scarcely 0·004 mm. wide, terminating abruptly in a very fine, almost imperceptible thread; 4. Not very abundant fragments of the articulated hairs (Fig. 30 *d*).

Thymele proteus, Linn. (Pl. G, Fig. 29). In this species, which is very similar to the last, the costal fold does not extend beyond the transparent spot in cell 12, and is even narrower than in *Th. protillus*. In the fold, jointed transparent hairs predominate (Fig. 29 *c*): the joints are 0·016 mm. to over 0·03 mm. long, and rarely more than 0·004 mm. wide. There are usually 7 to 12 of these joints united together. Besides these there are other scales of which the majority are about 0·2 mm. long by 0·02 mm. broad: they are pale, and traversed by a longitudinal, granular, opaque stria. In form they are slightly attenuate towards the base, and terminate in a small elliptical lamina, the width of which does not exceed, or even equal that of the base (Fig. 29 *a*). There are some smaller scales of a similar shape with a much narrower terminal lamina, and without the opaque longitudinal streak (Fig. 29 *b*).

Entheus vitreus, Cram. The costal fold of this elegant species is very narrow, and encloses jointed, transparent hairs. The joints, of which about ten or more are connected, are usually 0·015 mm. long by 0·004 mm. wide, but they are very variable in both these dimensions.

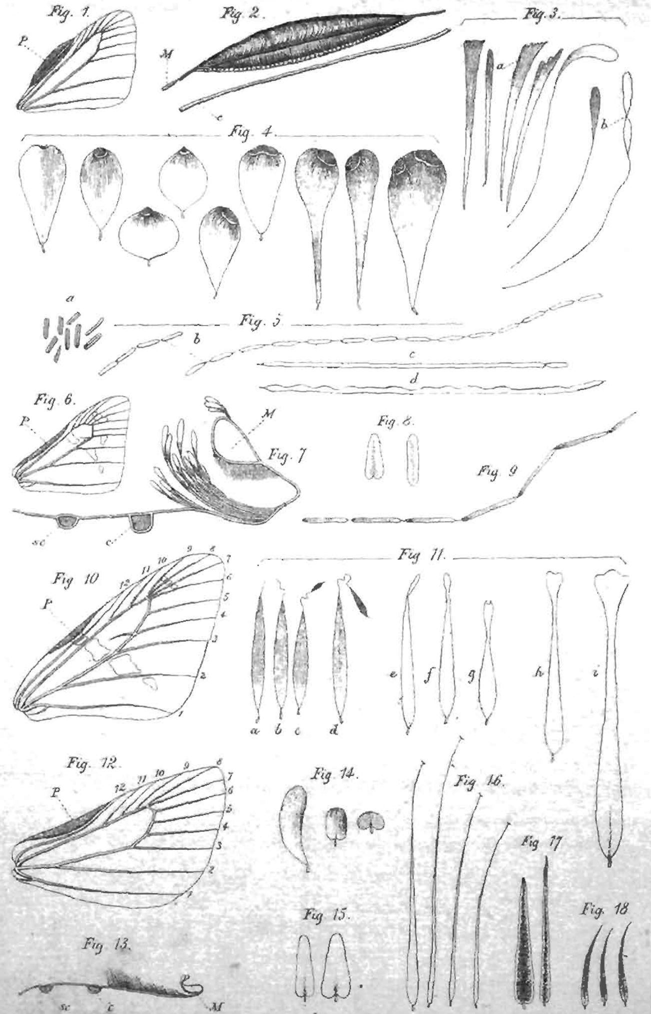
Besides these species, I have examined the costal folds of several others whose names I do not know. Inasmuch as observations such as these, which cannot be verified by others because the species are unknown, are of little value, I will confine myself to a few words on the most notable forms of scales or hairs which I found in these undetermined forms.

In a species of *Telegonus* (with transparent yellow spots, and a large silvery spot on the under surface of the hind-wings) the costal fold contained chiefly hair-like scales, transparent and very long (about 0·36 mm.) terminating suddenly in a very slender thread (Pl. G, Fig. 31 *a*). There were also present other scales (Fig. 31 *b*) like the smaller ones of *Thymele proteus* (Fig. 29 *b*), and a few fragments of jointed hairs.

In another species, the joints, which are very variable in length and breadth (Pl. G, Fig. 32), were united by very long filaments, which still adhered to the separated joints.

Finally, in a species closely resembling *Achlyodes thraso*, Hübn., the costal fold, which is very narrow, enclosed lanceolate, more or less opaque scales (Pl. G, Fig. 33 *b*, *c*), transparent threads (Fig. 33 *a*), remarkable for being furnished with a sort of transparent, fusiform root, or vesicular appendage, of about 0·025 mm. long by 0·008 mm. broad. Among other *Hesperidae* I once met with a similar root on a single scale in the fold of *Telegonus mercatus* (Pl. F, Fig. 11 *a*). In the sub-family of the *Pierinae* the scales dispersed over the surface of the wings in the male are almost always furnished with vesicular appendages.

As to the function of the folds in the *Hesperidae*, I think there can be no doubt that they belong to the class of scent-organs, which, infinitely diversified, distinguish the males of so many other Lepidoptera. A structure very similar to that of the *Hesperidae* is found in certain species of the genus *Papilio*, not, indeed, on the costal margin of the fore-wings, but on the inner margin of the hind-wings, which is folded over, and covers either a pencil of long hairs, or a dense pale down. In *Papilio protesilaus* the black brush exhales a strong, disagreeable odour, whereas the pale down of *P. nephalion* diffuses a pleasing aroma. That the function of the marginal fold on the hind-wings of *Papilio* is that of [preparing and diffusing] odours is evident, and by analogy it is also the use of the costal fold of the *Hesperidae*; for it is in every way probable that these similar structures exercise the same function.



Fritz Müller del. West, Newman photo-lith.

SCENT ORGANS AND SCALES OF MALE HESPERIDAE.

EXPLANATION OF PLATE F (Figs. 1–18).

Figs. 1–5.—*Telegonus midas*, Cram.

Fig. 1.—Natural size. Fore-wing with the costal fold opened out (P).

Fig. 2.—Magnified 3 times. Costal fold opened out. M, marginal nervure; *c*, costal nervure.

Fig. 3.—Magnified 25 times. Scales inserted along the line between the folded margin and the rest of the wing.

Fig. 4.—Magnified 25 times. Scales from the area covered by the [free] margin of the costal fold.

Fig. 5.—Articulated hairs, forming the source of the dark grey powder in the costal fold, magnified 180 times. *a*, detached particles; *b*, jointed hairs; *c* and *d*, imperfectly jointed hairs.

Figs. 6–9.—*Telegonus*, sp.?, from S. Bento.

Fig. 6.—Fore-wing with closed fold (P), natural size.

Fig. 7.—Transverse section through the middle of the costal fold, magnified 25 times. M, marginal nervure; *c*, costal nervure; *sc*, subcostal nervure.

Fig. 8.—Detached joints of hairs from interior of the fold, magnified 180 times.

Fig. 9.—Articulated hair, magnified 180 times.

Figs. 10, 11.—*Telegonus mercatus*, Fabr.

Fig. 10.—Fore-wing, with the costal fold (P) closed, twice natural size. 1, submedian or internal nervure; 2, 3, 4, first, second, and third branches of the median nervure; 5, second; 6, first branch of discoidal nervure; 7, 8, 9, 10, 11, fifth, fourth, third, second and first branches of the subcostal nervure; 12, costal nervure.

Fig. 11.—Scales from the interior of the fold, magnified 180 times.

Figs. 12–18.—*Hesperia syrichthus*, Fabr.

Fig. 12.—Fore-wing, magnified 3 times. P, costal fold.

Fig. 13.—Transverse section across the costal fold, magnified 25 times. M, marginal; *s*, costal; *sc*, subcostal nervures.

Fig. 14.—Scales inserted along the marginal nervure, magnified 30 times.

Figs. 15–18 are magnified 180 times.

Fig. 15.—Scales from the lower surface of the folded margin.

Figs. 16, 17.—Scales from the area covered by the folded margin.

Fig. 18.—Scales from the deepest part of the angle formed by the folded margin with the rest of the wing.

PLATE G (Figs. 19–23).

Figs. 19–22.—*Leucochitonea arsalte*, Linn.

Fig. 19.—Fore-wing, magnified 3 times. P, costal fold.

Fig. 20.—Transverse section through the middle of the fold, magnified 25 times.

Figs. 21, 22.—Scales from the interior of the fold, magnified 180 times.

Figs. 23–28.—*Thymele simplicius*, Stoll., male.

Fig. 23.—Fore-wing of male without costal fold, twice natural size. The cells are numbered according to Herrich-Schaeffer.

Fig. 24.—Transverse section of the same wing across the part occupied in other males by the costal fold, magnified 25 times. M, *c*, *sc*, marginal, costal and subcostal nervures.

Fig. 25.—Fore-wing of male with costal fold (P), twice natural size.

Fig. 26.—Transverse section across the middle of the costal fold, magnified 25 times. M, *c*, marginal and costal nervures.

Figs. 27–33 are magnified 180 times.

Fig. 27.—Scales from the interior of the costal fold.

Fig. 28.—Scales from the same part of another specimen.

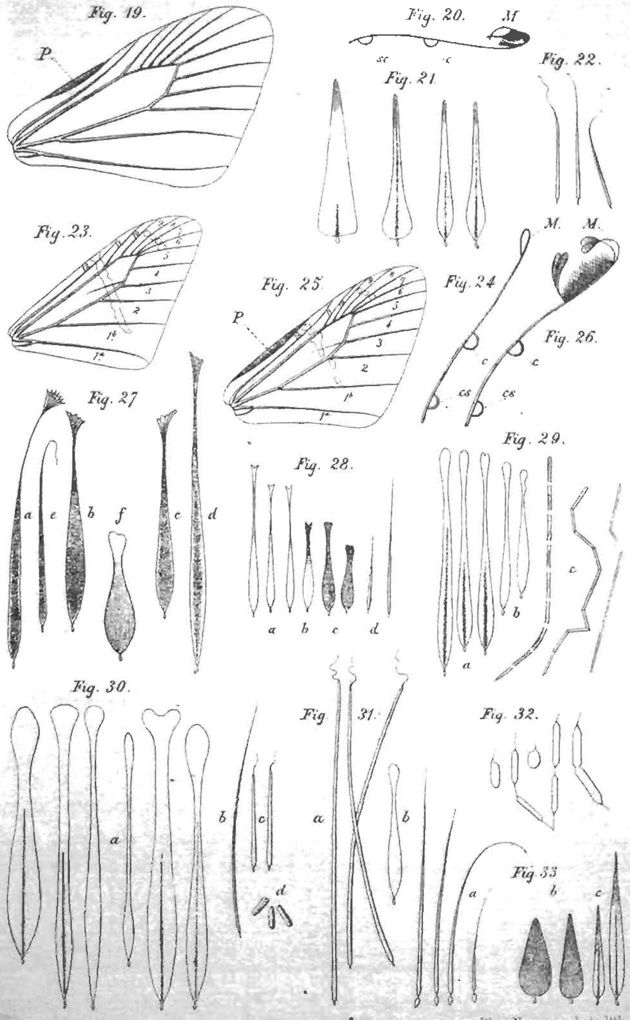
Fig. 29.—*Thymele proteus*, Linn., male. Scales from the costal fold.

Fig. 30.—*Thymele protillus*, Herr.-Sch., male. Scales from the costal fold.

Fig. 31.—*Telegonus*, undetermined species. Scales from the costal fold.

Fig. 32.—Fragments of articulated hairs from the costal fold of an undetermined Hesperid.

Fig. 33.—Hairs and scales from the costal fold of a species closely resembling *Achlyodes thraso*, Hübn.



Fritz Müller del. West, Newman photo-lith.

SCENT ORGANS AND SCALES OF MALE HESPERIDAE.

§ VIII. *Where is the Seat of the Musky Scent in Hawk Moths?*[1]

I. AMONG the thousands of European collectors of Lepidoptera not one appears to have asked this question. And yet with the question the answer would have immediately suggested itself; for in seeking the source of a strong smell one has only to follow one's nose.

While in Europe the Convolvulus Hawk Moth is not uncommon, and the musky scent of the male has long been known, I have to-day[2] for the first time taken in this locality a musk-scented male Hawk Moth, of a small species, only 40 mm. long, the name of which I do not know. It was flying round the many-blossomed, large blue heads of an Agapanthus in my garden.

It was at once evident, on smelling it, that the very powerful scent came from the ventral side of the abdomen. As I held the moth upside down between my thumb and forefinger, I noticed, that, when it fluttered its wings, a pale brush of musk-scented hairs was spread out on each side of the base of the abdomen. When the creature became quiet, the tuft was again withdrawn into an elongate groove, extending on each side over nearly the whole length of the first two segments, and disappeared, in consequence of the scales bounding the groove closing over it. In repose there was nothing to be seen of the tuft, and but little of the groove. The latter can be made visible in the dead insect by pressing the abdomen from behind forwards; and the groove is then seen between the separated scales as a narrow, bare longitudinal streak.

Again, therefore—but in a new place—we meet with the same efficient form of scent apparatus as is found, bearing perceptible odours, on the wings and at the apex of the abdomen in various males of diurnal Lepidoptera. I can scarcely doubt that the "tibial tufts" (Herrich-Schaeffer) which are found in *Hesperidae* and Heterocera serve to diffuse a scent attractive to the females, although I have not been able to perceive it,—for instance, in the males of *Pantherodes pardelaria*, a species

[1] *Kosmos*, III. (1878), pp. 84–85.

[2] Nov. 26, 1877. Fritz Müller gave a brief account of this observation in a letter, written Nov. 27, to Charles Darwin. Extracts from this letter were read by Meldola to the Entomological Society, and are published, together with a reproduction of F. Müller's diagrammatic drawing of the ventral aspect of the moth with the scent-tufts extended, in *Proc. Ent. Soc.*, 1878, pp. ii., iii.—E.B.P.

sometimes common here, a splendid panther-like, golden yellow black-marked [Geometrid] moth, *in which these tufts are powerfully developed.*

Does the musky scent proceed from the same spot in the males of the Privet and Convolvulus Hawks? Do those Hawk Moths in which the human nose can detect no scent, also possess similar scent-tufts? Both are probable. Let us hope that these points will soon be settled by actual observation.

II. The second of the above conjectures was founded chiefly on the behaviour of the tibial tufts of *Pantherodes pardelaria*, which spring from the base of the hind tibiae, extend along their full length, and are usually concealed in a deep longitudinal groove which runs along the inner side of the tibiae, and is covered by peculiar very large scales inserted along its edge. The unfolding of the tuft appears to be brought about by very vigorous stretching of the tibia.

That conjecture has since been confirmed. On one of our giant-moths belonging to the family of the *Erebidae*, with an expanse of wing of about 190 mm., I was able to detect a not particularly powerful, but quite unmistakable, peculiar scent emitted from the hind tibiae of the male. In this species the hind tibia is slender in the female, but strongly inflated in the male (4 mm. broad by 12 mm. long), and its entire inner surface is covered with a dense forest of hair, which the moth can erect into an enormous brush, while in repose it lies close along the tibia. In this state the hairs along the central line lie undermost, in a shallow groove, covered over by a dense layer of the lateral hairs, which are directed obliquely towards the central line and the apex of the tibia.[1]

Even as it is probable that the varied scent-producing structures, now confined to certain spots on the wings, have originated from scent-scales scattered over the whole surface, so we may, without difficulty, trace these *tibial tufts of Pantherodes pardelaria to the pubescence covering the whole* inner side of the tibiae, as shown in the above-mentioned Erebid males. We may adopt this conclusion with the less hesitation since we also find in the family of the *Erebidae* [a further stage of evolution in the presence of] hair-tufts at the base of otherwise hairless hind tibiae.

In the *Hesperidae* known to me, there is no arrangement for the concealment of the tufts on the tibiae; but I have seen in one of the larger forms, probably a species of *Antigonus*, that the tibial tufts were concealed in a groove formed by the scales of the abdomen.

Itajahy, 26 November, 1877.
(Signed) FRITZ MÜLLER.

[1] The Javanese Hesperid, *Ismene oedipodea* appears to resemble these *Erebidae*, the male having the hind tibiae strongly inflated ("extremely thick") and densely pubescent ("very densely hairy"). (Doubleday, Westwood, and Hewitson [printed "Hecoitron" in original], *Genera of Diurnal Lepidoptera*, p. 514.) It may also be mentioned here that Linné himself gave the name of "*odora*" to a species of Erebid. I have personally no knowledge of this species.—F.M.

§ IX. *The "Maracujá [or Passion-flower] Butterflies."*[1]

THE genera *Heliconius*, *Eueides*, *Colaenis*, and *Dione* (*Agraulis*) have been until now commonly divided between the two sub-families of the *Heliconinae* and *Nymphalinae*. *Colaenis* and *Dione* are placed in the latter; *Eueides* is placed sometimes by the side of *Colaenis* in the *Nymphalinae* (by Doubleday and Felder), or again with *Heliconius* in the *Heliconinae* (by Herrich-Schaeffer and Kirby).—Neither of these arrangements is in accordance with nature. *Colaenis* and *Dione* must be removed from the *Nymphalinae*, and united with *Heliconius* and *Eueides* in a separate sub-family.

The present paper sets forth in few words the proof of this assertion. The four above-named genera agree in the following particulars:—

1. All their species inhabit the warmer parts of America, and all, as far as is known, lay their eggs on species of "Maracujá" [or Passion-flower] (Passiflorae). This is true of *Heliconius eucrate* [*narcaea*], *Eueides isabella* and *aliphera*, *Colaenis dido* and *julia*, *Dione vanillae* and *juno*. No Nymphaline larva has hitherto been found on the Maracujá.

2. The eggs are yellow, shaped like a thimble, and the surface is covered with longitudinal and transverse furrows. Similar eggs do certainly occur among other diurnal Lepidoptera; but whether among the *Nymphalinae*, I do not know. On the other hand, one finds in the latter sub-family quite aberrant shapes, *e.g.* those of *Siderone*, resembling a broad, inverted smooth thimble, flattened at the top.

3. The larvae are spinose. The head bears two spines (in *Dione juno* represented only by two short pointed tubercles). The prothorax is usually spineless: in *Dione juno* alone is there a pair of small spines. Mesothorax and metathorax bear each two pairs of spines, placed not in the same transverse line, but one pair, the upper, about midway between the anterior and posterior margins, and the other close to the anterior margin of the segment. The abdominal segments, except the last, have each three pairs of spines placed in the same transverse line with each other and with the spiracles. The last segment bears two pairs of spines, of which the lower is the more posteriorly placed.

Among the *Nymphalinae* also there are many spinous larvae; but I do not know of any having exactly this arrangement of the spines, which,

[1] *Stettin Ent. Zeit.*, XXXVIII. (1877), pp. 492–496.

however, is found also in *Acraea.* It is true that the number of Nymphaline larvae which I have personally examined, together with those concerning which I have received satisfactory details (from my brother Hermann Müller) is not very large. But, in addition to spinous larvae, one finds among the *Nymphalinae*, many others without spines, but with horned heads, as in *Siderone* and *Protogonius.*

4. All the Maracujá butterflies confine themselves exclusively to honey from flowers: none of them drink the exuding sap of trees, as do many *Nymphalinae*, for example *Epicalia*, *Temenis*, *Callicore*, *Gynaecia*, *Ectima*, *Ageronia*, *Biblis*, *Aganisthos*, *Prepona*, *Agrias*, *Smyrna*, *Paphia*, and *Siderone.* They never seek moisture on the ground like the Nymphaline genera—*Hypanartia*, *Eunica*, *Haematera*, *Apatura*, etc., or even on horse-droppings, like *Pyrameis.* All Maracujá butterflies appear to prefer the same kinds of flowers: thus, for instance, all the species here (*Heliconius beschei*, *apseudes* and *eucrate* [*narcaea*], *Eueides isabella* and *aliphera*; *Colaenis julia* and *dido*; *Dione vanillae* and *juno*) with the exception of the excessively rare *Eueides pavana* and *Dione moneta*, visit industriously and continuously a *Poinsettia* in my garden, to which the *Nymphalinae* only contribute an occasional visitor in *Anartia amalthea*, and even this species never remains long on the profusely flowering bushes.

5. The males of the Maracujá butterflies when seized, open wide the anal valvulae, from the inner side of which then appear two glands yielding a strong and nauseous smell. The females, on the contrary, emit a similar smell from a yellow gland extruded on the dorsum between the last and penultimate abdominal segments. I know of nothing similar among the *Nymphalinae.*

6. The antennae and mouth-parts of all the species agree in every important detail, without, it is true, showing anything especially characteristic. This is particularly the case with the appendage beside the mandibles, shaped like a flat club, bearing at its apex an obliquely directed bristle. This is the usual shape of the structure, which is probably to be regarded as an organ of taste: in other groups of Lepidoptera it takes different and characteristic forms.

7. The hind-wings of the males bear on those parts of the upper surface that are overlapped by the fore-wings, peculiarly shaped, marginally-fringed scales, "scent-scales," similar to those which occur on the upper surface of the wings of the male *Pieris* [*Aporia*] *crataegi.* I know of no such scent-scales in *Nymphalinae* or in *Acraea.*

8. The longitudinal veins and the border [hind or outer margin] of the wings bear, on the under surface, one or two rows of black hairs. In *Acraea* one finds similar hairs, not only on the fully developed veins, but also on the course of the aborted third inner marginal vein [between the median and the submedian] of the hind-wings. I have been unable to find them in any *Nymphalinae* that I have examined.

9. The neuration of the wings in all Maracujá butterflies is extraordinarily similar. This agreement is especially noticeable if one compares the neuration of the various species, and best of all, by the comparison of enlarged drawings. The difference between *Heliconius* and *Eueides* on the one side, and *Colaenis* and *Dione* on the other, consists in the fact that the former pair have a closed, the latter an open, cell in the hind-wing; but this difference is scarcely noticed, so completely does it disappear under the overpowering impression of similarity. To put this into words would require too long an explanation. I therefore confine myself to pointing out a few peculiarities—easily overlooked because of their apparent unimportance—as proof of the close blood relationship of all the Maracujá butterflies.

(*a*) The median vein of the fore-wing gives off, near the base, a short [interno-median] spur, running towards the inner marginal [submedian] vein, its point curving towards the border [hind or outer margin],—in most species, as in *Colaenis* [*Metamorpha*] *dido* and *Dione vanillae*, very distinct, but only slightly developed in *Colaenis julia* and *Dione juno*. A similar spur is found in some other species of various families, as in *Morpho* and among the *Nymphalinae* in *Adelpha* (*Heterochroa*). But it is wanting, so far as I know, in all the Nymphaline genera, for which any claim to close relationship with the Maracujá butterflies could be made, as also in *Acraea*.

(*b*) In the cell of the fore-wings there springs from the angle between the median and subcostal veins, the stump, more or less long and distinct, of the aborted discoidal. This basal stump extends especially far in *Eueides aliphera*, is especially stout in *Colaenis* [*Metamorpha*] *dido*, and least distinct in *Colaenis julia*. I have sought in vain for any trace of this vestige of the discoidal in *Acraea* and in many *Nymphalinae*.

(*c*) Not far from the base of the wing the subcostal vein becomes suddenly thinner at a point where its posterior boundary sharply bends in towards the anterior, the latter preserving its direction unchanged. This is the spot at which the subcostal formerly divided into its two chief branches, of which the posterior subsequently disappeared right down to its origin from the anterior. It is sometimes possible, as in *Colaenis* [*Metamorpha*] *dido* and *Heliconius eucrate* [*narcaea*], to trace fairly distinctly the course of this lost branch of the subcostal through the whole length of the cell. Even in specimens of the same species, this former dividing point of the subcostal is not always equally recognizable: it is usually most distinct in *Heliconius eucrate* [*narcaea*], *Dione vanillae* and *Dione juno*. I have not been able to detect any trace of it in *Acraea* or among the *Nymphalinae*.

(*d*) As to the hind-wings, I will only remark on the praecostal vein curved towards the base of the wing, which distinguishes the Maracujá butterflies from *Acraea* and also probably from all those *Nymphalinae* which may claim to approach them.

It does not appear necessary to discuss the weight of the above-noted characteristics. For Systematists of the old school I do not write; for all others, it seems to me, the significance of such characteristics lies on the surface.

One may well inquire how has it been possible, that masters of Lepidopterology have managed to misunderstand a relationship which, as I know from my own family, strikes every child at his first sight of the butterflies on the wing—a relationship which constantly receives fresh confirmation as one learns more and more of their development, life-history, and structure?

That *Eueides* should have been tossed to and fro between *Heliconius* and *Colaenis* is comprehensible, so long as these two genera were placed in different [sub]families. For *Eueides* (at least as imago, since the very aberrant pupa has not long been known) is barely distinguishable from *Heliconius* by the shorter antennae, and from *Colaenis* by the closed cell of the hind-wing. Furthermore, *Eueides isabella* and *Heliconius eucrate* [*narcaea*] on the one side, and *Eueides aliphera* and *Colaenis julia* on the other, bear such deceptive resemblance in the form, colour, and markings of the wings, that one might easily take each *Eueides* for a smaller specimen of the other species. But how it was possible to tear *Colaenis* away from *Heliconius*, let him understand who may. In the detailed statement of the generic characters given by Doubleday, one finds the sole and only important character which distinguishes *Colaenis* from *Heliconius* to be the open cell in the hind-wing of the former; but this self-same character distinguishes *Colaenis* in exactly the same way from abont 50 ont of the 113 genera of *Nymphalinae* mentioned by Herrich-Schaeffer. Furthermore, Herrich-Schaeffer himself states that this very character is insufficient to separate species otherwise similar into different genera, and, in accordance with this opinion, he unites in the same genus *Adolias*, species with open, and others with closed cell. And yet he places *Heliconius* in the first, and *Colaenis* in the tenth family of his diurnal Lepidoptera!

Haeckel's admonition to naturalists to ground themselves more thoroughly in philosophy, and especially in logic, truly appears to be not unnecessary.

Itajahy, Sta. Catharina, Brazil, April, 1877.

The following paper by Fritz Müller should also be consulted: "Acraea and the Maracujá Butterflies as larvae, pupae, and imagines" (*Kosmos*, II. (1877–8), pp. 218–224).—E.B.P.

§ X. *The Scent-scales of the Male "Maracujá Butterflies."*[1]

WITH PLATE H, FIGS. 1, 2.

THE sense of smell plays an important part in the sexual relations of many creatures, among which the Lepidoptera are included. The males of many Hawk Moths and Heterocera can scent the virgin females from incredible distances. But on their part also, many male butterflies diffuse scents, which are undoubtedly agreeable to the females and arouse their sexual desires. It has long been known that the Privet and Convolvulus Hawk Moths, especially during flight, diffuse a strong musky scent, although the spot from whence it arises has not hitherto been discovered. The males of a moth of the genus *Cryptolechia* and those of the *Glaucopidae,* which are related to the German *Zygaenidae,*[2] exsert from the apex of the abdomen two long hollow filaments, sometimes as long as the body, from which proceeds a scent which is often very powerful and to man sometimes appears to be agreeable, sometimes offensive, suggesting, for instance, chloroform and prussic acid. Similarly with the splendid South American butterflies, the gigantic Morphos, whose males extrude from each side of the apex of the abdomen a hairy, strong-smelling gland, of which the scent in the glorious blue *M. adonis* and *M. cytheris,* resembles vanilla. The wings far more frequently than the abdomen are the seat of the scent diffused by the male. To name only a few of the species distinguished by especially strong scents: the male of *Papilio protesilaus,* a species similar to the "sailing butterflies" ("Segelfalter"),[3] with diffusely scaled, transparent wings, has the inner or posterior margin of the hind-wings broadly folded upwards; if the wings are drawn strongly forwards, the fold opens, and a bristling, dense beard of long black hair is seen, while at the same time a strong scent becomes perceptible. In the family of the Whites (*Pierinae*) *Leptalis thermesia* and the Brimstone *Callidryas cipris,* remarkable for its slightly tailed hind-wings, are notable in this respect: in both the scent emanates from a patch of peculiar scales, situated on the upper surface of the hind-wings near the costal

[1] *Kosmos,* I. (1877), pp. 391–395.

[2] *Glaucopis* = *Syntomis.* The view that the *Syntomidae* are nearly related to the *Zygaenidae* is now abandoned.—E.B.P.

[3] Dr. Karl Jordan informs me that the "Segelfalter" or "sailing butterflies" include *Papilio podalirius* and its allies—the group called "*Cosmodesmus,*" by Haase, and "Kite swallow-tails," by Rothschild and K. Jordan.—E.B.P.

margin, and also covered, in *C. cipris*, with a mane of long hairs. In the males of almost all the *Brassolinae*—large, *Morpho*-like, but less brilliantly coloured insects, which are on the wing especially in the early morning and towards the evening—the hind-wings are furnished with scent-organs in very different positions and of various forms. I noticed an unusually strong musky smell in a *Dasyopthalma*, taken on the heights of the Serra, and in this species the male bears, on the blue-black upper surface of the hind-wing, an oval, ochre-yellow brand, intersected by the discoidal, and behind it in the cell a long pencil of dull yellow hairs, which the insect can erect and expand at will. In the males of many species of *Thecla* there is on the upper surface of the fore-wing, near the apex of the cell a generally dark-coloured patch, formed by abnormally shaped, very firmly fixed scales: in the larger species one can usually detect a scent emanating from this patch. In the splendid *Thecla atys* it is very strong, so as to be noticeable as soon as one has the creature in the net, and withal disagreeable and bat-like.

All these and other scent-organs have this in common, that as long as the insect is at rest, they are well concealed and protected against evaporation, it may be between the wings, between the wings and abdomen, in special grooves, or in pockets formed by a folding over of the margin of the wings (as for instance, in the so-called "costal folds" of many *Hesperidae*), or in the interior of the body, as in the exsertible glands and filaments of *Morpho* and the *Glaucopidae*. These brushes and manes form extremely effective perfume sprinklers, being saturated with the perfume when at rest, and then, when suddenly spread out, unfolding an enormous surface for evaporation.

One is fully justified in attributing the same significance to all these similar contrivances, so widely spread among the Lepidoptera, even where no scent has as yet been detected, and even if such is actually not perceptible to the human olfactory organs.

Naturally these extremely diverse types of scent apparatus did not suddenly appear in their present perfection, but must have been developed from more simple conditions. And inasmuch as many of these are comparatively recent developments, as is proved by their widely different structure in closely allied genera, or even within the same genus (*e.g. Papilio*), the hope that we may yet discover such simpler conditions is not wholly unjustified. Since sometimes even well-developed scent-patches (as in *Callidryas philea*[1] male) or hair-tufts (*Mechanitis lysimnia* male) do not distribute any perfume perceptible to us, it is natural that one must from the first give up all hope of detecting such simple forms by means of the nose, and must ascertain their significance in some other manner. And it can, as a matter of fact, be demonstrated, that there are on the wings of various butterflies scale structures, which can with great probability be regarded as simple, original scent-organs. Among these the scent-scales

[1] See, however, the terminal note on p. 615.—E.B.P.

of the male "Maracujá butterflies" are especially remarkable, since there can be scarcely any doubt as to their true significance.

The "Maracujá butterflies," as I call them after the plant on which, as is well known, the larvae of all the species live,[1] form a group of closely allied species confined to the warmer parts of South America.[2] Their long narrow wings give them a look all their own, while their colours—generally beautiful, pure, and deep—render them, like *Morpho*, a real ornament to the South American landscape.

They have been divided into four genera, *Heliconius*, *Eueides*, *Colaenis* and *Dione* (*Agraulis*), and these genera have hitherto been commonly—incomprehensibly one might say, if under the current system of classification anything could be so called—placed in two different subfamilies or families, the *Heliconinae* and *Nymphalinae*.

Colaenis and *Dione*—and even *Eueides*—have been torn away from their closest relative *Heliconius*, and thrown together with *Ageronia*, with *Apatura*, with *Siderone!* Allied in the very closest manner by geographical distribution, by the structure of the larva as well as of the imago, even in their preferences for certain flowers,[3] they do not appear to approach very closely any other genus of diurnal Lepidoptera. *Acraea* is perhaps nearest, its larvae agreeing in all important points with those of the Maracujá butterflies.

In all the male Maracujá butterflies that have been examined there are on the upper surface of the hind-wing—near the costal margin and especially along the costal and subcostal nervures—among the ordinary scales certain others of very striking shape, such as I have only seen elsewhere in a male "White" of the genus *Hesperocharis*. The apical margin—usually strongly arched—has a dense fringe, which appears as if stuck together with some foreign substance. The fringes of a *Eueides aliphera*, which I bred from a pupa and killed in the course of the first day, appeared almost clean. The scales, with the exception of a pale border along the fringed margin, appeared dull and opaque: their stalk, unlike that of ordinary scales, is slender, thin-skinned and flabby, and the socket in which it is inserted is much larger than that of other scales—spherical, and broadly dark margined, as if it contained some strongly refractive substance. The shape, as shown in Plate H, Fig. 1 *a–e*, is somewhat variable.

[1] There have been found here on the "Maracujá" (*Passiflora*) the larvae of *Heliconius eucrate* [*narcaea*], *Eueides isabella* and *aliphera*, *Colaenis julia* and *dido*, *Dione vanillae* and *juno*.—F.M.

[2] The group extends up to the northern limits of the Neotropical Region, and one or two species even enter the United States.—E.B.P.

[3] *Poinsettia pulcherrima* in my garden was visited last year by numerous species of *Thecla* and a few *Erycinidae*, but only rarely and exceptionally by other diurnal Lepidoptera, excepting the Maracujá butterflies, of which almost all the local species came regularly and remained constantly near the plants. Only *Eueides pavana*, which I saw but three or four times, and *Dione moneta*, which I saw but once, were wanting.—F.M.

In the males of *Colaenis* [*Metamorpha*] *dido* the scales occur elsewhere than on the upper surface of the wings. I first observed their arrangement more accurately in *Heliconius besckei* (Pl. H, Fig. 2). The scales of the diurnal Lepidoptera form, as is well known, transverse rows, each one nearer the base of the wing covering the insertion of the succeeding row like slates on a roof. In each row two kinds of scales alternate, those resting on the membrane of the wing (lower scales) being broader and shorter, the others resting on them (covering scales) narrower and longer.

Where, on the area already described, this regular arrangement is fully carried out, the scent-scales take the place of the covering scales; but their points of insertion rarely lie in the same line as those of the other scales, being usually nearer to the base of the wing. Where the arrangement of the scales is less regular—especially along the costal nervure, where the scent-scales are most numerous—these latter are also apparently scattered quite irregularly among the others.

Their significance as scent-scales is indicated by—(1) their restriction to the male sex; (2) their occurrence at that place, where above all others, the scent structures are found. Here, viz. on the part of the hind-wing covered by the posterior margin of the fore-wing, is found, among the *Danaidae*, the scent apparatus in species of *Euploea*, here the long hair-tufts of *Ithomia*, *Mechanitis* and most of the *Heliconius*-like *Danaidae* [*Ithomiinae*]; among the *Satyridae*, the large white scent-patch of *Gnophodes morpena*, the hair-tufts of various species of *Mycalesis*, a patch with long black silky hairs in *Bia actorion*; among the *Elymniinae*, the hair-tufts of *Elymnias*; among the *Morphinae*, the oval leather-brown patch of *Zeuxidia*, and the tufts of *Tenaris*, *Clerome* and *Thaumantis*; among the *Brassolinae*, the oval patch of *Dasyophthalma*; among the *Nymphalinae*, the patch of *Lachnoptera*; among the *Pierinae*, the scent-patch of several species of *Leptalis*, *Callidryas*, *Nathalis*, etc.; among the *Hesperidae*, the tufts of *Caecina*; finally among moths (*Hyponomeutidae*) the long light grey hair-tufts of *Trichostibas*.

3rd. The fringes on the apical margin, which both favour the collection of the perfume when the wings are closed, and also its rapid evaporation, as soon as the wings are spread.

4th. The socket in which the stalk is placed, exactly like those found in scent-patches diffusing a strong unmistakable scent.

Of the genera usually placed near the Maracujá butterflies, I have only examined *Acraea*, *Argynnis* and *Melitaea* (of the latter both the Alpine species, collected by my brother Hermann Müller), but have been unable to discover on the wings anything similar to the scent-scales of *Heliconius*, *Eueides*, *Colaenis* and *Dione*. Thus even this inconspicuous character confirms once again the close affinity uniting the members of the Maracujá group and their isolation.

Besides the scents which the male butterflies emit to make themselves acceptable to the female they are courting, many species produce odours

which are offensive to insect-eating birds and other enemies, and are thus protective. Such scents can be at once distinguished by the fact that they occur in both sexes alike, and that the insect emits them when in danger, as for instance, when it is caught hold of. The Maracujá butterflies, among others, possess such a protective scent, and it is very powerful. If one takes hold of any species, male or female, there appear at the apex of the abdomen yellow glands, differently shaped and situated in the two sexes, but in both alike emitting the same objectionable scent. This circumstance might well raise doubts as to the significance attributed above to the scent-scales: it might seem strange that the male should possess, in addition to a very strong scent for scaring foes, another extremely weak perfume to attract the females. To this we may reply, that at least one case is known in which both scents occur, their sources of origin being also close together. *Didonis biblis*, a pretty, medium-sized, black butterfly with a broad red band along the margin of the hind-wings, has in both sexes, on the dorsal surface of the abdomen, between the fourth and fifth segments, a blackish hairy double gland, which is exserted when the creature is seized, but the male possesses in addition a white-haired gland also double, which stands out in strong contrast against the black abdomen, between the fifth and sixth segments, and is never voluntarily exserted by the captured butterfly: this is entirely wanting in the female. With care, it is possible to press forward alternately the anterior and posterior gland, and to assure oneself of the difference between the perfumes. By means of this example, the significance attributed above to the scent-scales of the male Maracujá butterflies—which can scarcely be contested—loses that strangeness which it would possess were it an isolated case.

EXPLANATION OF PLATE H.

Fig. 1.—Scent-scales of male Maracujá butterflies, magnified 180 times. *a*, *Heliconius apseudes*; *b*, *H. beschei*; *c*, *Eueides aliphera*; *d*, *Colaenis* [*Metamorpha*] *dido*; *e*, *Dione juno*.

Fig. 2.—Arrangement of scales in *Heliconius beschei*. *a*, lower scales; *b*, covering scales; *c*, scent-scales.

Fig. 3.—Part of inner marginal [submedian] vein of fore-wing of *Dione vanillac*, male, 90; 1.

Fig. 4.—Part of vein 4 of *Colaenis* [*Metamorpha*] *dido*, male, 45; 1.

Fig. 5.— ,, ,, 2 of *Colaenis julia*, male, 90; 1.

Fig. 6.—Scent-scales of *Colaenis julia*, male. A, hind-wing; B, fore-wing.

Fig. 7.—Scent-scales of *Dione vanillae*, male.

Fig. 8.— ,, ,, *Euptychia hesione*, male.

Fig. 9.— ,, ,, *Erebia goante*, male.

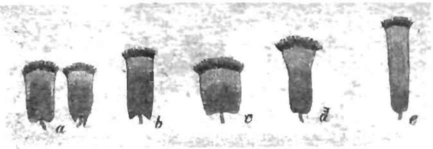


FIG. 1.

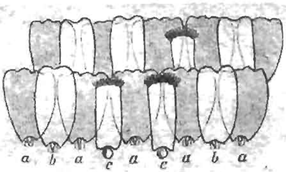


FIG. 2.

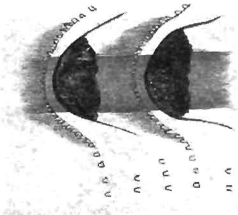


FIG. 3.

FIG. 6. FIG. 7. FIG. 8. FIG. 9.

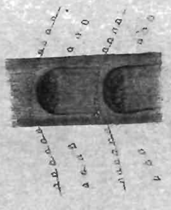


FIG. 4. FIG. 5.

Fritz Müller del.

SCENT-SCALES OF MALE "MARACUJÁ BUTTERFLIES," ETC.

§ XI. *The Scent-scales of the Male of* Dione vanillae.[1]

PLATE H, FIGS. 3–9.

Dione vanillae leads, I might say compels, me to recur to the scent-scales of the Maracujá butterflies, because their shape and arrangement in this insect differs so greatly from that of most of its allies.

Although in some years the commonest of the Maracujá butterflies, *Dione vanillae* has been so scarce this year that I have only recently, at the approach of winter, received the first male. When I looked for scent-scales in the usual place, on that part of the hind-wing which is covered by the fore-wing, I could find no trace of them; but the peculiar appearance of the nervures of the fore-wing showed me at once where to search. The first six veins of this wing (adopting Herrich-Schaeffer's notation; therefore the inner marginal [submedian] vein and the branches of the median and discoidal [radial]) appear on the foxy-red ground colour as broad, inflated black streaks, and further examination shows that these streaks are composed of a row of dilatations running transversely across the vein and separated from one another by the naked, scaleless parts of the vein. On these dilatations stand densely packed scent-scales, whose shape reminds one rather of those of many *Satyridae* than of the other Maracujá butterflies.

However much one may be accustomed to find so-called "secondary sexual characters" taking very different forms in closely allied species, I was surprised to find such a radical difference within such an exclusive circle as that of the Maracujá butterflies. The surprise vanished when I became convinced that the arrangement of the scent-scales in *Dione vanillae* is connected with that of the other Maracujá butterflies, by intermediate forms.

In *Heliconius*, where the scent-scales are confined to that part of the hind-wing covered by the fore-wing, they are always most numerous along the veins. In *Colaenis dido* male, as I believe I mentioned in my first communication, the scales are not confined to that one spot, but scattered over the whole wing, and, as a more accurate investigation has now shown, they occur exclusively on the veins. They are found on veins 2–8 of the hind-wings, also on 1–7 of the fore-wings, being most numerous on those veins of the hind-wings which are covered by the fore-wings. All the

[1] *Kosmos*, II. (1877–78), pp. 38–41.

rows of scales on the wings run, as usual, uninterruptedly, almost straight —being only slightly curved towards the base of the wing—across the veins, on which the scales are more crowded than elsewhere. Here, on the vein between every pair of rows of ordinary scales lies a group of scent-scales in a densely packed transverse double row (Pl. H, Fig. 4).

In *Colaenis julia*, male, the scent-scales of the hind-wing are confined to the veins 7 and 8, which are covered by the fore-wing: they are especially numerous on 7, the first branch of the subcostal, and are here arranged as in *Colaenis* [*Metamorpha*] *dido*. But besides these, there are scent-scales on the fore-wing also, on veins 1–3, which even at this stage show an arrangement recalling that of *D. vanillae*. Only the scales of every other row curving towards the base of the wing, run uninterruptedly across the veins and the scales which lie actually on the veins are longer, narrower, and more closely packed than elsewhere, and overhang a semicircular, somewhat depressed patch, covering about two-thirds of the breadth of the vein, a patch which is densely packed with scent-scales (Pl. H, Fig. 5).

In *Dione juno*, male, the scent-scales appear to be wanting from that part of the hind-wing covered by the fore-wing. It is true that a few are sometimes found among the scales taken from that area, but I could never determine whether they had been really inserted there. They do, however, occur both on veins 2–6 of the hind-wing and 1–6 of the fore-wing, being arranged as in *Colaenis dido*. Where they are especially numerons, as on the inner marginal [submedian] vein of the fore-wing, the rows of scales are more strongly curved and on the vein the groups of scent-scales contain more rows, so that the arrangement approaches that of the fore-wings of *Colaenis julia*.

Finally, in *Dione vanillae*, male (Pl. H, Fig. 3), the scent-scales are confined to veins 1–6 of the fore-wing. On 1, the inner marginal [submedian] vein, they occupy the distal two-thirds of the length, on 2, 3 and 5 the whole length, on 4 they are prolonged basally beyond the end of the cell, while on 6 they begin a little beyond the cell. In this species only every third row of scales runs uninterruptedly across the scent-scale bearing veins, and is strongly curved towards the base. About half of the space between every two of the rows which cross the veins is occupied by a patch of densely packed scent-scales, extending beyond the vein on each side.

As in the arrangement, so also in the shape of the scales, *Colaenis julia* forms a transition between *Colaenis dido* and *Dione vanillae*. The scent-scales of the hind-wing (Pl. H, Fig. 6 A) resemble closely, both in arrangement and shape, those of *Colaenis dido*, while those of the fore-wing (Pl. H, Fig. 6 B), almost twice as long, far more slender, and contracted into a neck below the apex—to some extent recall by their shape the scales of *Dione vanillae*.

In this last species the long, rod-like scent-scales (Pl. H, Fig. 7) attain

a length of about 0·7 mm. An opaque, expanded clavate base, which recalls the scent-scales of some "Whites" [*Pierinae*], is followed first by a slender transparent stalk of about one-eighth of the total length, then by an elongate, narrow lancet-shaped section which again contracts into a slender stalk, finally by a narrow, elongate, rounded and fringed terminal plate. The scales which, in a densely packed semicircle, surround the scent-scale area are three times as long as the other scales, and differently formed: they appear to furnish a sort of protective fence to the scent-scales.

Among the scent-scales of other butterflies known to me, those of various *Satyridae* are somewhat similar to *Dione vanillae.*

In colour and marking, and especially in the silvery patches on the under side of the wings, *Dione vanillae* comes so close to many of the Fritillaries, *e.g.* the German *Argynnis aglaia,* that I once more examined these latter butterflies for scent-scales. On those parts of the hind-wing covered by the fore-wing, where I had previously sought them, I had found none; but I have now discovered them, as in *D. vanillae*, on the nervures of the fore-wings. In the males of *Argynnis aglaia* and *niobe*, they appear to be confined to veins 1–4, and are not united into groups, but irregularly distributed. Their shape is similar to those of *Erebia goante* (Pl. H, Fig. 9). A more exact description may well be left to those who are able to examine them in a fresh condition.

Finally I give a synopsis of the occurrence of scent-scales in the above-mentioned species.

Heliconius	Fore-wing	veins	7–8 ;	Hind-wing	veins	0
Eueides	„	„	7–8 ;	„	„	0
Colaenis julia	„	„	7–8 ;	„	„	1–8
Colaenis dido	„	„	2–8 ;	„	„	1–7
Dione juno	„	„	2–6 ;	„	„	1–6
Dione vanillae [1]	„	„	1–6 ;	„	„	0
Argynnis aglaia and niobe	„	„	1–4 ;	„	„	0

[1] In this species, as well as in *A. aglaia* and *A. niobe*, the figures for the fore- and hind-wings are accidentally transposed in the original table.—E.A.E.

there remain only the stalk and the long sharp thorn-like teeth, so that the scales resemble two- to four-pronged forks, often wonderfully bent and twisted.

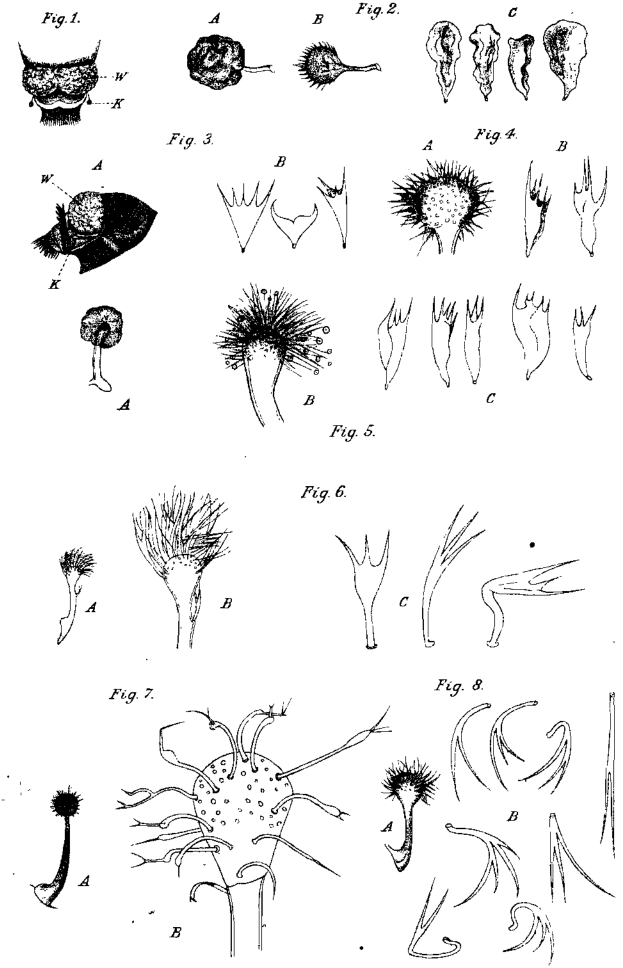
The scales of *Dione juno* (Pl. J, Fig. 7 B) are metamorphosed in an entirely different manner, and can scarcely be recognized as scales. An elongate, but rarely straight, stalk is widened at the apex into a tiny "palm," which may even be entirely wanting. From the palm, or from the apex of the palmless stalk, spring one, two, or rarely three bristles, either immediately, or separated from the palm by another kind of stalk which is usually straight and also much shorter and thinner than the basal one. These various parts stand at all sorts of angles to each other, thus making an incredible number and variety of strange forms. It may also happen that the stalk instead of widening into a palm, forks, and each branch of the fork bears one or two bristles.

In contrast with the stiff, forked thorns of *Dione vanillae* are the scales on the stink-clubs of *Colaenis* (Pl. J, Fig. 2 C), which are metamorphosed into flabby, thin-skinned, usually strongly folded and crumpled plates, without any notching of the apical border.

Whatever may be the form of these scales, they can hardly be seen on the fresh stink-club, except perhaps in insects that have just emerged. Among them is heaped a yellow, scented mass, which is also exuded from the surface of the stink-gland. The scales are stuck together and often completely covered by this substance, so that the stalk bears at its apex a nearly smooth or slightly rough ball, with a diameter two or three times as large as that of the club itself (Pl. J, Figs. 2 A, 5 A, 7 A). With alcohol, ether, or benzine, this sticky mass can be softened, partly dissolved, and finally more or less completely removed. The undissolved residue takes the form of strongly refractive, more or less spherical particles (Pl. J, Fig. 5 B) or of irregular clots.

I have not found similar stink-clubs in any Lepidoptera except these females of the Maracujá butterflies. It appears, as a general rule, that the stink structures found in both sexes are much less wide-spread and much less varied than the scent-glands peculiar to the male, of which, now that attention has been directed to them, new and astonishing forms are almost daily discovered.

Itajahy, Sta. Catharina, Brazil, June, 1877.



Fritz Müller del. West, Newman lith.

STINK GLANDS AND CLUBS OF FEMALE "MARACUJÁ BUTTERFLIES"

DESCRIPTION OF PLATE J.

Fig. 1.—*Colaenis julia*, female. Apex of abdomen with protruded stink-glands, seen from above, about 5 times natural size. W, stink-gland; K, club.

Fig. 2.—*Colaenis* [*Metamorpha*] *dido*, female. A, stink-club in fresh condition; 15; 1. B, the same cleaned, 15; 1. C, scales from club, 90; 1.

Fig. 3.—*Heliconius apseudes*, female. Apex of abdomen, lateral view, with the stink-gland artificially forced out, 15; 1. W, stink-gland. K, club. B, scales from club, 90; 1.

Fig. 4.—*Heliconius besckei*, female. A, head of stink-club, cleaned, 45; 1. B, scales of same, 90; 1.

Fig. 5.—*Heliconius eucrate* [*narcaea*], female. A, fresh stink-club, 15; 1. B, head of same cleaned, 45; 1. C, scales of same, 90; 1.

Fig. 6.—*Eueides isabella*, female. A, stink-club from a freshly emerged insect, 15; 1. B, head of same, 45; 1. C, scales of same, 90; 1.

Fig. 7.—*Dione juno*, female. A, a fresh stink-club, 15; 1. B, the head, cleaned, only a few of the appendages shown, 90; 1.

Fig. 8.—*Dione vanillae*, female. A, a stink-club, 15; 1. B, thorn-like scales from same, 90; 1.

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